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Review of implementation on land

Report of the Secretary-General

Summary

Land- and water-use practices and climatic conditions affect the condition of land resources. Degraded land has negative effects on agricultural productivity and rural development. To reverse land degradation, long-term investments across sectors and stakeholders are required. Integrated land management approaches that promote holistic management of all related resources have shown promising results. Certain uses of land can drive climate change (for example, land uses leading to deforestation), others can mitigate it through, for example, carbon sequestration. Despite considerable progress in the development of information systems and tools for land-use planning, their adaptation has been slow.

Secure access to land and other natural resources is an essential part of local empowerment of marginalized individuals and groups and can be instrumental in poverty reduction. Access to land is often seen as a prerequisite to gaining access to other productive resources. Challenges that need to be addressed for sustainable and efficient land management include: providing secure land rights, strengthening capacities of communities, adapting land-use planning technologies, and improving the provisioning of data.

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I. Introduction

1. The present report reviews progress made in the implementation of Agenda 21,[1] the Programme for the Further Implementation of Agenda 21[2] and the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation"),[3] in the thematic area of land. It takes into account decisions taken at the third, fifth and eighth sessions of the Commission on Sustainable Development on this thematic area. The report draws on inputs provided by Governments, major groups and the United Nations system, in particular the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP).

II. Review of progress

2. Chapter 10 of Agenda 21, adopted by the United Nations Conference on Environment and Development, calls for an integrated and sustainable approach to the planning and management of land. The third and eighth sessions of the Commission on Sustainable Development, held in 1995 and 2000, respectively, urged Governments to take a strategic land management approach aimed at creating enabling conditions, particularly for interaction between urban and rural areas, including particularly marginalized groups. Furthermore, it was decided that such an approach should take into consideration the livelihood opportunities of people living in poverty, in particular in rural areas. The Johannesburg Plan of Implementation adopted by the World Summit on Sustainable Development in 2002, reaffirmed these decisions and called for policies and laws that would guarantee well-defined and enforceable land- and water-use rights and promote legal security of tenure. It also called for the promotion of environmentally sound, effective and efficient use of soil fertility improvement practices and for strengthening partnerships and international cooperation towards increasing financial resources for these and related activities.[4]

A. Changes in the resource base

1. Extent and impact of land degradation

3. Land degradation in all its forms poses a serious threat to economic development, food security and rural livelihoods, especially in the poorest regions of the world.[5] It not only diminishes productivity, biodiversity and other ecosystem services, but also has implications for climate change. Available statistics show that

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992*, vol. I, *Resolutions Adopted by the Conference* (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

[2] General Assembly resolution S-19/2, annex.

[3] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 1, annex.

[4] See Agenda 21, chap. 10; reports of the Commission on its third and eighth sessions, in particular decision 8/3; Johannesburg Plan of Implementation, para. 40.

[5] See World Bank, *Sustainable Land Management: Challenges, Opportunities, and Trade-Offs* (Washington, D.C., World Bank, 2006).

land degradation affects approximately 50 per cent of agricultural lands on moderate slopes and 80 per cent of lands on steep slopes; and 25 per cent of farm households suffer significant soil losses each year.[6] Some of the effects of poor land-use practices result in declining agricultural yields, higher costs to maintain production levels and higher vulnerability to extreme events such as landslides and wildfires. *Global Environment Outlook 4*[7] states that "land degradation in the form of soil erosion, nutrient depletion, water scarcity, salinity and disruption of biological cycles is a fundamental and persistent problem".

4. Attempts to map desertification are often unsatisfactory. A key requirement for mapping desertification is that it be defined in a way that leads to objective and practical measurement criteria. Earth-observing instruments carried on satellites routinely map land surface variables that respond to desertification, such as albedo, surface temperature, and vegetation cover. However, factors such as rainfall that do not relate to desertification also affect these properties.[8] It has been suggested that a persistent reduction of net primary production below its potential that does not disappear during wetter periods could furnish a reliable and practical measurement of desertification.[9]

5. There are signs of land recovery, mainly in the form of regeneration of the natural vegetation. While much of large-scale degradation had occurred prior to 1980, the trends suggest that net overall increase in vegetation started to occur beginning in the early 1980s. This trend was confirmed by some recent studies, mainly based on the analysis of remotely sensed data, which concluded that the world has benefited from higher rainfall and that vegetation cover has increased, particularly, in the Sahel, since the early 1980s.[10]

2. Interactions of land and water resources

6. There is a correlation between different land-use types and both the quantity and quality of water resources. Globally, 70 per cent of available freshwater is green water, held in the soil and accessible to plants, whereas only 11 per cent is blue water, accessible as stream flow and groundwater. Better soil and water management can greatly increase land productivity, the resilience of farming systems, and the availability of water resources.

7. Land management techniques that lead to erosion or involve a relatively high input of agrochemicals have a negative influence on the quality of water. Nutrient loading by industries, including agro-industries, leads to toxic algae bloom and human health problems, as well as negative effects on fish populations and aquatic ecosystems, such as coral reefs.

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[6] World Bank, Soil Fertility Initiative, 1997.

[7] United Nations Environment Programme, *Global Environment Outlook* (*GEO*) *4* (2007).

[8] *Millennium Ecosystem Assessment* (Washington, D.C., Island Press, 2005), chap. 22 ("Dryland Systems").

[9] See S. D. Prince, "Spatial and temporal scales of measurement of desertification", *Global Desertification: Do Humans Create Deserts?*, M. Stafford-Smith and J. F. Reynolds, eds. (Berlin, Dahlem University Press, 2002), pp. 23-40.

[10] See S. Herrmann and others, "Recent trends in vegetation dynamics in the African Sahel and their relationship to climate", *Global Environmental Change*, vol. 15 (2005), pp. 394-404; and A. Anyamba and C. J. Tucker, "Analysis of Sahelian vegetation dynamics using NOAA-AVHRR NDVI data from 1981-2003", *Journal of Arid Environments*, vol. 63, No. 3 (2005), pp. 596-614.

Box I
Green Water Credits

Green Water Credits (GWC) constitute a mechanism for the transfer of cash to rural people in return for land and water management activities that determine the quantity and quality of all freshwater. These activities are currently mainly unrecognized and unrewarded. It is argued that direct payment will enable better management of water and land resources. Better soil and crop management can enhance infiltration, reduce run-off and erosion and reduce evaporation from the soil. A study by the International Soil Reference and Information Centre (ISRIC) found that small cash transfers from downstream water users will enable farmers to adopt sustainable management of land and water while at the same time contributing to rural development by diversifying income. It was further found to be a practical way to assess water resources, optimize their allocation, and calculate cost and benefits. By creating a market between water users and water service providers, an ongoing Green Water Credits project aims to support the current water reform in Kenya, which assigns an economic value to water.

Source: International Soil Reference and Information Centre (ISRIC) (http://www.isric.org/UK/About+ISRIC/Projects/Current+Projects/Green+Water+Credits.htm).

8. Lessons learned and achievements have been reported through several international and regional conferences[11] and research by, inter alia, the Consultative Group on International Agricultural Research (CGIAR) Challenge Programme on Water and Food.[12] Green Water Credits, as explained in box I, constitute one mechanism for rewarding integrated land and water management.

9. Integrated water resources management (IWRM) has been identified by countries as a means to improve the interaction in the management of land and water resources. Its implementation, however, is impeded by many challenges including poor land-use practices and lack of institutional capacity. An enabling environment characterized by the necessary environmental, economic, social, cultural, political and institutional conditions is considered vital to improve the integrated management of land and water resources.

3. Forest ecosystems

10. The historical decline in temperate forests has been reversed, with an annual increase of 30,000 square kilometres (km^2) between 1990 and 2005. Deforestation in the tropics, having begun later, continued at an annual rate of 130,000 km^2 over the same period. Exploitation of forests has been undertaken at the expense of biodiversity and natural regulation of water and climate, and has undermined

[11] These include, inter alia, the International Conference on Integrated River Basin Management in Contrasting Climate Zones (University of Hohenheim, Stuttgart, Germany, 2005); East African Integrated River Basin Management Conference (Morogoro, United Republic of Tanzania, March 2005); and a high-level Workshop on Integrated River Basin Management in Latin America (Mexico City, April 1999).

[12] CGIAR Challenge Programme on Water and Food (http://www.waterandfood.org/).

subsistence support and cultural values for some peoples. Concerns over massive deforestation for plantations include the loss of valuable forests that protect fragile soils, loss of habitats for wildlife and, consequently, reduced biodiversity. In addition, emissions from greenhouse gases as well as landslide and flood risk increase. Many countries, however, have demonstrated the political will to improve management of their forests by revising forest policies and legislation and strengthening forestry institutions. Most countries manage forests for multiple uses, and increasing attention is being paid to the conservation of soil, water, biological diversity and environmental services of forests.

11. Innovative management is required to maintain and restore ecosystems. Its effectiveness depends on good governance; however, there is a recognized lack of institutional capacity in many countries to implement, in particular, community-based management schemes. A range of technical responses, legislation and non-binding agreements, such as the non-legally binding instrument on all types of forests,[13] designed to conserve forests and foster ecosystem services, as well as financial mechanisms to support them, have been created. Some countries have developed payment-for-environmental-services schemes as a way to reward forest owners for the production of non-market benefits. As a prerequisite to the success of such schemes, proceeds need to be adequately assessed, collected and invested.

12. From 1990 to 2005, Africa lost more than 9 per cent of its forest area, more than half of this loss having been due to wildfires. Deforestation and uncontrolled forest fires are especially severe in countries suffering from war or other civil conflict. However, forests are obtaining political support and commitment at the highest levels in Africa. For example, the Conference of Ministers in Charge of Forests in Central Africa is an effective forum for regional collaboration in addressing serious environmental issues in relation to forests. While increasing the area of forests to be managed primarily for conservation of biological diversity by 3.5 million hectares to almost 70 million hectares, a majority of countries in the region have also adopted new forest policies and laws, along with increasing their efforts to improve law enforcement and governance.[14]

13. The Latin American and Caribbean region, together with Africa, loses its forests at the highest rates globally. The loss of forests is mainly due to conversion of forests to agricultural land. Countries are making considerable efforts, however, to retain their primary forests. There has been over a 2 per cent increase in the area of forests designated primarily for conservation of biological diversity. Latin American countries have also formed networks to fight forest fires and increase the effectiveness of protected area management. Several countries in the region are among the global leaders in undertaking innovative approaches to forest management, such as payments for environmental services.

4. Interrelationship of climate change and land resources

14. There is a clear linkage between land degradation and climate change.[15] Land degradation negatively affects ecosystem services, in particular nutrient cycling, the global carbon cycle and the hydrologic cycle. Land use also has an effect on the

[13] Economic and Social Council resolution 2007/40 of 17 October 2007, annex, appendix.

[14] Food and Agriculture Organization of the United Nations, *State of the World's Forests, 2007* (http://www.fao.org/docrep/009/a0773e/a0773e00.htm).

[15] Global Environment Facility, "Land degradation as a global environmental issue" (2007).

amount of solar radiation reflected from the surface (high reflection in snow-covered areas) and the amount of solar radiation absorbed (high absorption in forest plantations). Deforestation leads to a higher proportion of sunlight reflected. Large-scale changes in reflection of the land surface due to land uses, such as deforestation, contribute to climate change.[16]

15. Sustainable land management depends upon the efficient functioning of related ecosystems. For example, carbon pools in soil and surface vegetation, particularly forests, are very large but easily disturbed. They are affected by unsustainable land management practices and by the type of land degradation that is prevalent (be it, for example, water erosion, deforestation or soil compaction). Estimates of historical contributions of agriculture to atmospheric greenhouse gases, the amounts and rates of carbon lost as a consequence of deforestation and conversion of land to agriculture and other soil-vegetation-atmosphere carbon fluxes, such as those involving decay of peat and peat fires, all suggest that various forms of land use have had a very significant impact on climate, through raising greenhouse gas concentrations. The Intergovernmental Panel on Climate Change (IPCC) estimates in its Fourth Assessment Report that the greenhouse gas emissions through land use, land-use change, and forestry have grown between 1970 and 2004 by 40 per cent.

16. The Fourth Assessment Report further states that the resilience of many ecosystems is likely to be overtaxed during this century by an unprecedented combination of climate change, associated disturbances (for example, flooding, drought, wildfire, insects and ocean acidification) and other drivers of global change (for example, land-use change pollution, overexploitation of resources, etc.). In addition, heavy precipitation events, likely to increase in frequency, trigger soil erosion and waterlogging of soils. In addition, the Panel estimates that by the end of this century, sea-level rise induced by climate change will lead to increased salinization of irrigation water. Land and land-use systems in some regions will be more affected than land and land-use systems in other regions, with water stress and reduced crop production in sub-Saharan Africa; coastal erosion and inundation of small islands; and flooding from the sea and the rivers of the Asian mega-deltas.

17. Climate change is also likely to have severe effects on the agricultural sector, particularly in the developing world, for example, by negatively impacting water quantity and quality in many water-scarce regions. In addition, conditions conducive to wildfires increase in the absence of rain and with the increase of temperatures. Population growth is one factor contributing to the expansion of settlements into areas naturally susceptible to wildfires. This has resulted in an increase of both wildfire frequency and the size of the affected area in many parts of the world.[17] Some regions are considering forming networks of rapid-response teams to effectively respond to the increase in wildfires.

18. Traditionally, disaster relief rather than disaster prevention receives the main share in resources. Often, the mobilization takes time; the funds are insufficient and earmarked according to donors' priorities. Recently, projects for managing risks focusing on reducing vulnerability and establishing adequate coping mechanisms, such as risk insurance, are gaining momentum.

[16] Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (2007).

[17] Global Fire Monitoring Center (http://www.fire.uni-freiburg.de/).

19. Terrestrial ecosystems, which have been classified by IPCC as highly vulnerable to climate change, include tundra, boreal forests, mountains and coastal regions. The Panel estimates that 20-30 per cent of plant and animal species are at risk of extinction. Sea-level rise and human development are together contributing to losses of coastal wetlands and mangroves and increasing damage from coastal flooding in many areas. In other parts of the world, snow cover is projected to contract. Widespread increases in thaw depth are projected over most permafrost regions.

20. The spatial heterogeneity of climate change impacts on cereal production and its consequences for food security was explored by the International Institute for Applied Systems Analysis in 2002.[18] Recent work on the topic of global warming concludes that agriculture in some parts of the world, such as Northern and Eastern Europe would benefit from initial warming, but developing countries and especially the countries of Africa will likely be severely impacted.[19]

21. Mechanisms to expand markets for emission reductions in agriculture, forestry, and other land uses present an opportunity to benefit from sustainable land management approaches. The Clean Development Mechanism and Joint Implementation under the Kyoto Protocol[20] to the United Nations Framework Convention on Climate Change[21] present opportunities to finance reforestation and afforestation. New initiatives, such as the BioCarbon Fund of the World Bank, aim to deliver cost-effective emission reductions, while promoting biodiversity conservation and poverty alleviation.

B. Integrated land-use planning and management

22. Demands on land resources and the risks to sustainability are likely to intensify. Population growth, economic development and urbanization are driving demands for food, water, energy and raw materials; the continued shift in human diet from cereal to animal products, requiring a higher input in land and water resources, and the recent move towards biofuels add to the demand for farm production, all of this with implications for land uses. Already 700 million people in 43 countries live below the water-stress threshold of 1,700 cubic metres per person per year.[22]

23. Preventing land degradation is usually more effective and cost-efficient than rehabilitating degraded lands. Rehabilitating land already degraded involves facilitating the recovery of the soil's physical integrity, improving the nutrient status and increasing the amount of organic carbon in the soil.

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[18] Gunther Fischer, Mahendra Shah and Harrij van Velthuizen, "Climate change and agricultural vulnerability" (International Institute for Applied Systems Analysis, 2002) (http://www.iiasa.ac.at/Research/LUC/JB-Report.pdf).

[19] Robert Mendelsohn and Larry Williams, "Comparing forecasts of the global impacts of climate change", *Mitigation and Adaptation Strategies for Global Change*, vol. 9, No. 4 (October 2004), pp. 315-333; and William R. Cline, *Global Warming and Agriculture: Impact Estimates by Country* (Washington, D.C., Peterson Institute for International Economics, July 2007).

[20] FCCC/CP/1997/7/Add.1, decision 1/CP.3, annex.

[21] United Nations, *Treaty Series*, vol. 1771, No. 30822.

[22] United Nations Development Programme, *Human Development Report: Beyond Scarcity: Power, poverty and the global water crisis* (Basingstoke, United Kingdom, Palgraw Macmillian, 2006).

1. Land planning

24. Modernizing land planning and administrative systems has not always resulted in greater transparency, and many developing countries still lack access to modern technology as a tool for improved land-use planning, especially at the local level. Growth in urban centres is often not equitable, as low-cost housing developments frequently lose out to more lucrative alternatives, serving the middle- and higher-income classes. The poor are forced to settle on marginal lands. The scarcity of land, particularly in Latin America and the Caribbean, has considerably increased land prices in large cities.

25. Slums, whether peri-urban squatter areas, shanty towns or rundown inner-city neighbourhoods, are characterized by substandard housing, overcrowding and absence of clear tenure arrangements. These informal settlements also lack basic services such as safe water, improved sanitation and electricity. Often they are prone to environmental hazards. Today, there are about 1 billion slum-dwellers in the world. The vast majority of these, more than 930 million, are living in developing countries, where they constitute 42 per cent of the urban population. In the urban areas of the least developed countries, slum-dwellers account for 78 per cent of the population. The proportion of slum-dwellers is particularly high in sub-Saharan Africa (72 per cent of the urban population) and in Southern Asia (59 per cent).[23]

26. Every year 19.5 million hectares of agricultural land is converted to spreading urban centres and industrial developments, often forcing farmers onto shrinking and more marginal lands. The uncontrolled expansion of human settlements constitutes a challenge for sustainable land planning and management. Particularly the concentration of people and cities in coastal areas increases the demand for limited land resources. Coastal areas are among the most crowded regions in the world.[24]

2. Approaches to sustainable land management

27. During the last 20 years, the exponential expansion of cropland has slackened; land resources are now used more intensively. In the last 25 years, the average production per hectare of cropland increased by almost 40 per cent.[25]

28. Biological nutrient cycling has benefits for land resources and land users. Practices include integrating legumes into the cropping system, improving fallows and applying agroforestry. Widespread adoption, however, is yet to be achieved, and for severely nutrient-deficient soils, there is no remedy except external nutrient inputs.

29. A growing number of communities have shown that it is possible, through improved land management, to increase productivity while having a positive environmental impact. For example, 1.8 million farmers in sub-Saharan Africa on average raised crop yields by 250 per cent on 1.9 million hectares of land and improved their environment through locally appropriate sustainable land management practices. Similarly for rangeland and woodland management, there are

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[23] United Nations Human Settlements Programme (UN-Habitat), *Enhancing Urban Safety and Security: Global Report on Human Settlements, 2007* (London, Earthscan, 2007).

[24] United Nations Environment Programme, Global Programme of Action for the Protection of the Marine Environment from Land-based Activites: Physical Alteration and Destruction of Habitats programme (http://gpa.unep.org/content.html?ln=6&id=199; http://padh.gpa.unep.org/).

[25] United Nations Environment Programme, *Global Environment Outlook (GEO) 4* (2007).

documented good practices that are adapted to local conditions.[26] Agroforestry in north-east Thailand, for example, increased food security, fuelwood security and soil fertility.

30. Conservation agriculture is an approach combining practices of minimal soil disturbance, permanent soil cover and crop rotations to achieve sustainable and profitable agriculture for improving the livelihoods of farmers. It aims at enhancing natural soil regeneration processes involving improved management of organic matter in the soil as well as efficient use of rainfall, soil moisture and plant nutrients; and the maintenance of physical properties of the soil by keeping mechanical tillage for direct planting and seeding to the absolute minimum.

31. Progress is being made in introducing and adapting conservation agriculture systems that were developed and adopted over the last two decades by farmers, ranging from small- to large-scale ones in Latin America, Northern America, Australasia and Central Asia, and smallholders as well as commercial farmers in Africa, South and South-East Asia and the Near East. Although this approach has not yet been widely adopted in sub-Saharan Africa, the area under conservation agriculture is expanding in Kenya, Madagascar, South Africa, Uganda, the United Republic of Tanzania and Zambia. Conservation agriculture systems have also been successfully piloted in West Africa (for example, by Burkina Faso, Mali and the Niger) and in Central Asia (for example, by Kazakhstan and Pakistan). Costs involved for transforming conventionally managed agricultural land, however, is an impediment to the wider adoption of conservation agriculture. Some farmers are also resistant to change farming practices.

32. Conservation agriculture systems have proved to be effective in improving and maintaining land productivity and resilience in respect of drought, run-off and erosion in a range of scales and ecological zones. Other benefits include significant savings in labour and energy for tillage and weeding. Additional advantages include risk reduction due to reliable yields, food security, cost savings and improved coping capacity of the agricultural system with respect to climate variability and change because of enhanced soil and crop health and moisture conservation.

33. The African Centre for Fertilizer Development has developed an integrated farming system designed to achieve multiple goals: improvement in crop yields, improvement in the diet of farmers, increase of cash incomes for farmers, soil and water conservation, increase of soil fertility, and labour-saving (because of reduced labour availability in the region). This farming system combines proper and timely input use (organic and mineral fertilizers, liming, seed and agrochemicals); conservation tillage; and diversified intercropping systems and agroforestry. It has been able to return more than 100 per cent per year on working capital and considerable savings on labour for weeding.

34. The International Fertilizer Development Centre has developed an integrated soil fertility management package of sustainable inputs and practices raising agricultural productivity that is promoted through a participatory approach. The combined use of soil amendments, organic materials and mineral fertilizers replenishes plant nutrients in the soil and improves cost-effectiveness of external inputs. The yields are 2 to 3 times higher than national yields. The return on capital

[26] Andrew Noble and others, "Development of 'bright spots' in Africa: cause for optimism" (2005) (http://www.iwmi.cgiar.org/brightspots/).

invested exceeds 100 per cent, and returns to family labour are 2 to 6 times higher than the average salary in sub-Saharan Africa. The project operates in Benin, Burkina Faso, Ghana, Mali, the Niger, Nigeria and Togo, with more than 2,000 farmers in 100 villages selecting, trying out and adapting the methods in their own fields. A prerequisite for increasing the use of fertilizers is to develop capacity for their use that is responsible and effective so as to avoid the pollution of aquifers and damage to ecosystems, while at the same time achieving as much cost-effectiveness as possible.

35. Watershed management is critical to the sustainability of land and water resources. Set-asides, reforestation and soil conservation on a large scale are essential in upland areas. In floodplains, land zoning to provide space for inevitable flooding is preferable to costly and, eventually, often unsuccessful efforts to control floods.[27] Forests decrease run-off more effectively than crop- and grasslands, thus decreasing the susceptibility of the land to erosion.[28]

36. Municipalities in several countries, including Brazil, Costa Rica, Ecuador, Mexico and the United States of America, have been investing in watershed management to safeguard or improve the reliability and quality of their drinking-water supplies. In New York City, for example, paying landowners to change land-use practices proved to be a cost-effective way to meet the municipal objective of improving the quality of water resources, and also contributed to conservation of the land resources in the watersheds. In Brazil, in the State of São Paulo, an inter-municipal consortium, jointly with local and international partners, has been addressing a similar issue.

37. Since 2000, the Lao People's Democratic Republic has been implementing a programme aimed at: (a) improving the conservation and management of natural resources within a watershed to enhance their economic use; and (b) alleviating poverty and improving sustainable livelihood opportunities. The programme seems to be helping the country in reversing unsustainable resource management practices and addressing poverty reduction through sustainable livelihoods.[29]

38. The Declaration of Atitlán, Guatemala (2002), outcome of the Indigenous Peoples' Global Consultation on the Right to Food, held in Atitlán, Sololá, Guatemala, from 17 to 19 April 2002, emphasized the importance of indigenous knowledge and practices for sustainable agriculture and food systems and also calls for improving the dissemination of indigenous knowledge on the impacts of agrochemicals and genetic engineering. In this regard, the Food and Agriculture Organization of the United Nations (FAO) and indigenous peoples' organizations undertook the preparation of a paper exploring the scientific basis for some traditional indicators used by indigenous people to guide decision-making related to

[27] David Grey and Claudia Sadoff, "Water resources and poverty in Africa: essential economic and political responses", paper presented at the African Ministerial Conference on Water, Abuja, 2002.

[28] I. R. Calder, *The Blue Revolution: Land Use and Integrated Water Resource Management* (London, Earthscan, 2005).

[29] P. Pravongviengkham and others, "Integrated watershed management for sustainable upland development and poverty alleviation in Lao People's Democratic Republic" (proceedings of the Asian Workshop, Kathmandu, 11-13 September 2003) Watershed Management and Sustainable Mountain Development Working Paper, No. 5 (Rome, Food and Agriculture Organization of the United Nations, 2005).

agricultural practices. This initiative aimed to support indigenous peoples' capacity and underline the legitimacy of indigenous land management approaches.[30] The United Nations Declaration on the Rights of Indigenous Peoples, adopted by the General Assembly on 13 September 2007 (Assembly resolution 61/295, annex) confirms the right of indigenous peoples to self-determination and recognizes subsistence rights and rights to lands, territories and resources.

39. Farmer field schools are increasingly recognized as an effective means for building capacity of farmers and service providers (facilitation, extension and research). Many provide training in participatory diagnosis and constraints analysis; farmer empowerment; and farmer experimentation, innovation and adaptation to local contexts. Substantial progress has been made, for example, in Kenya and Sierra Leone, in adapting farm field schools for many subject areas: crop, livestock, soil and water management; marketing; life support-coping with HIV/AIDS; nutrition; and post-emergency interventions.

3. Financing mechanisms for integrated land management

40. Along with project and programme funding by national Governments (see box II), international agencies and development banks, an increasing range of financing mechanisms have stimulated integrated land resources management in the last decade. These have facilitated payments for ecosystem services such as water supply and quality (box I) and payments for carbon sequestration — regulated under international agreements such as the Clean Development Mechanism, as well as in the form of voluntary contributions through non-governmental initiatives. The Clean Development Mechanism allows payments for land-use change such as afforestation, but not for increasing soil carbon contents through conversion from conventional plough-based agriculture to land management methods such as conservation agriculture.

41. Changes oriented towards better integrated land management result in improvements of the ecosystem and offer land users economic incentives. For example, Rainforest Alliance[31] certification of coffee, cacao, fruits and flowers requires ecosystem management and protection of wildlife and waterways but also opens a profitable niche market. Another example is the South Africa Biodiversity and Wine Initiative, which has created a viable marketing opportunity, highlighting sustainable natural resource management and efforts to conserve the natural heritage of South Africa. In the last decade, the Initiative has helped to ensure the participation of winegrowers with more than 40,000 hectares, representing 40 per cent of the total vineyards in Cape Province. It resulted in setting aside natural habitat in contractually protected areas and also entailed a change in farming practices to enhance the suitability of vineyards as a habitat, stimulating biodiversity, and reduce negative impacts in and outside vineyards.

[30] Food and Agriculture Organization of the United Nations Sustainable Agriculture and Rural Development (SARD) Initiative: SARD and Indigenous Culture (http://www.fao.org/sard/en/init/964/2687/2453/index.html).

[31] Rainforest Alliance (http://www.rainforest-alliance.org/certification/).

Box II
China's "Grain for Green" programme

A series of devastating floods in 1998, led China, in 1999, to start the "Grain for Green" programme. One of the largest conservation set-aside programmes in the world, its main objective is to increase forest cover on sloped cropland in the upper reaches of the Yangtze and Yellow River Basins to prevent soil erosion. When the programme is available in their community, households set aside all or parts of certain types of land and plant seedlings to grow trees. In return, the Government compensates the participants with in-kind grain, cash payments and free seedlings.

By the end of 2002, officials had expanded the programme to some 15 million farmers in more than 2,000 counties in 25 provinces and municipalities in China. If the programme meets its original goals, by 2010 nearly 15 million hectares of cropland will have been set aside, affecting the land of more than 50 million households.

Source: Emi Uchida, Jintao Xu and Scott Rozelle, "Grain for Green: cost-effectiveness and sustainability of China's conservation set-aside program", *Land Economics*, vol. 81, No. 2 (2005), pp. 247-264.

42. The export of high-value, high-quality produce can also provide the resources to improve land management as well as land and environmental quality. In the highlands of Madagascar, for example, almost 10,000 small farmers are producing hand-picked fine French beans and other vegetables for European supermarkets, where they fetch up to three times the price paid for industrially produced French beans. A variety of standards have been created, including ethical employment practices (for example, no child labour). To satisfy these standards, the exporting company has combined its microcontracts with farmers with extensive farm supervision and assistance. This includes teaching the farmers how to make compost as a means for maintaining soil structure and improving water-holding capacity.

43. The success of collaborative management depends on financing mechanisms that are long term, flexible and based on cost-sharing and offer incentives to support private initiatives in watershed conservation.[32] Some countries have already established environmental or forest trust funds (box III) to finance watershed management activities.

44. Through the Financial Information Engine on Land Degradation (FIELD), the Global Mechanism of the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa,[33] is aiming to progressively build up and maintain comprehensive inventories of financial resources, needs and flows in order to combat desertification to the benefit of all stakeholders. The aim is to collect and disseminate information

[32] Food and Agriculture Organization of the United Nations, Forestry Department, *The new Generation of Watershed Management Programmes and Projects*, FAO Forestry Paper 150 (Rome, Food and Agriculture Organization of the United Nations, 2006) (http://www.fao.org/docrep/009/a0644e/a0644e00.htm).

[33] United Nations, *Treaty Series*, vol. 1954, No. 33480.

not only to ensure a rational use of existing resources for the implementation of the Convention, but also to identify gaps in resource flows, and to facilitate implementation of the action programmes.

Box III
Environmental trust funds and watershed management in Bhutan and Viet Nam

The Bhutan environmental trust fund was set up to finance nature conservation and biodiversity projects. Donors contribute to the Government's core fund for implementing environment-related activities under its national programme. Interest from the fund is spent on projects, while the capital is locked to generate funding for future projects.

The Viet Nam trust fund for forests was set up in 1999 under the Ministry of Agriculture and Rural Development. It is supported by international donors for the implementation of the Forest Sector Support Programme and other Government programmes for the forest sector, including the 5 million hectares reforestation project. The objectives include: (a) aligning donor support more closely to the priorities identified in the Support Programme framework; (b) targeting poverty alleviation with respect to donor support to the forest sector; (c) harmonizing aid to the forest sector and reducing transaction costs; and (d) supporting the transition towards a sector-wide approach.

Source: Watershed Management and Sustainable Mountain Development Working Paper, No. 5 (Rome, Food and Agriculture Organization of the United Nations, 2005).

45. The TerrAfrica partnership programme and its Strategic Investment Programme for Sustainable Land Management in Sub-Saharan Africa are designed to help unlock the potential for progress through sustainable land management.[34] TerrAfrica is based on the premise that sustainable land management mainstreaming and upscaling is key to ecosystem stability and development in sub-Saharan Africa. It provides partners in sub-Saharan Africa with an operational framework for mainstreaming and upscaling cost-effective and efficient sustainable land management through three strategic approaches: regional partnership; knowledge generation and dissemination; and investment development and alignment. TerrAfrica provides partners with a common platform for supporting African leadership and better targeting and aligning investment at multiple levels.

4. Impact of crop prices on land resources

46. Crop prices influence the relative profitability of land management options and thus land allocation decisions for alternative production scenarios. If markets are inefficient and prices are distorted, land and other natural resource endowments may be significantly undervalued. This may lead to over-consumption and resource degradation. For example, low stumpage fees, that is to say, the prices charged by a

[34] TerrAfrica (http://www.terrafrica.org/).

landowner to companies or operators for the right to harvest timber on his or her land, coupled with low prices for fertilizers and pesticides along with the absence of environmental service markets and effective regulation, is likely to result in land degradation.

47. Accordingly, changes in policies responding to market forces can lead to drastic change in established land-use systems. For example, a factor in the increase in grain prices in 2007 has been the rapidly expanding demand for ethanol as biofuel. The promotion of ethanol, particularly in the United States of America, led to the conversion of land for maize production, where wheat and soy had been previously grown.

48. The global demand for biofuels also fuelled the expansion of agricultural production and the clearing of forests and savannah lands in Latin America and Asia. The decrease in wheat and soy production fuelled prices for these crops, which led to the expansion of their production in Brazil, whose export of sugar cane, a much more efficient crop for biofuel production in comparison with maize, is limited by tariffs.

49. Another factor for changes in crop prices with implications for land uses is changing consumption patterns. For example, higher income in some countries, most notably China and India, has increased global meat consumption. That now significantly more grain than 20 years ago is consumed for animal production is another factor that has led to an increase in grain prices. The increase in prices for grain makes it more profitable to intensify production and to cultivate on marginal lands, thus increasing the pressure on ecosystems.

5. Information systems and tools for land-use planning

50. Information systems on land resources, and land use, as well as relevant socio-economic settings are crucial to ensure informed decision-making for integrated land use. Accessibility of this information is important to ensure participation of all relevant stakeholders affected by changes.

51. Knowledge and information concerning water, terrain, climate, land use and socio-economic factors as well as land cover have increased in recent years, mainly through technological developments. Notably, enhanced imagery from remote sensing satellites has led to a better description of how global land cover is changing.

52. Efforts continue to improve deficient information systems on many aspects of agricultural land use and management at different levels, and to strengthen capacities in this field.[35] As a result, notable progress has been made over the last five years in the compilation and dissemination of data at global to regional scales that are useful for policy formulation.

53. Also, networks and projects with a focus on land cover have been developed in recent years (see box IV, for example).[36] Available data on water availability,

[35] FAO GeoNetwork (http://www.fao.org/geonetwork/srv/en/main.home).

[36] FAO Global Land Cover Network (http://www.glcn.org/news/); FAO Forest Resources Assessment (http://www.fao.org/forestry/site/fra/en/); and FAO/UNEP Land Degradation Assessment in Drylands project (http://lada.virtualcentre.org/pagedisplay/display.asp).

quality and use, mainly related to agriculture, are being compiled;[37] data on land suitability and potential changes in land suitability due to climate change are being explored;[38] and information on soil and terrain are being compiled.[39]

54. Mapping of soils has barely progressed and most countries have been abandoning soil surveys as a routine activity since the late 1980s. One notable exception is the continuing work on soil surveys in the United States. To overcome this knowledge gap, rapid soil visual assessment methods have been developed and adapted to various contexts. Such methods will enable farmers and local service providers to make better management decisions and to assess impacts of various technologies based on their better knowledge of soil constraints and differences. More sophisticated tools are also being developed for soil assessment and soil biodiversity characterization by the World Agroforestry Centre (ICRAF), using infrared and other recent technological developments.

Box IV
Participatory land-use development in Bosnia and Herzegovina

In Bosnia and Herzegovina, an ongoing joint project had created an inventory using a geographic information system reflecting the current state of the country's land resources and a land evaluation system based on the FAO Agro-ecological Zoning (AEZ) methodology. In the second phase, a land evaluation system at local level was introduced by developing the concept of economic-ecologic zoning (EEZ).

The participatory land-use development approach was introduced and implemented in 10 pilot municipalities, based on the concepts of negotiated territorial development. These municipalities now have GIS databases and economic-ecologic zoning as planning tools. A series of workshops have been organized to train Government, municipality and non-governmental organization staff in the concepts and the use of the methodology.

The Ministry of Agriculture recently decided to create units for rural land redevelopment in order to follow up and coordinate rural development and land resources management.

Source: Inventory of the post-war situation of land resources in Bosnia and Herzegovina (http://www.plud.ba/).

C. Access to and distribution of land

55. The lack of clearly defined tenure and access rights to land and other natural resources is particularly problematic for poor rural land users, preventing them from undertaking the necessary investments in sustainable natural resource

[37] FAO Aquastat (http://www.fao.org/nr/water/aquastat/main/index.stm).

[38] Agro-ecological Zones (AEZ) methodology (http://www.iiasa.ac.at/Research/LUC/SAEZ/index.html).

[39] FAO Global Soul and Terrain Database (SOTER) (http://www.fao.org/landandwater/lwdms.stm).

management.[40] Where the poor do have rights over resources, they are often held as common property, particularly in many countries in Africa. Various forms of programmes to address the issue of property rights have been undertaken in developing countries, including agrarian reform, community forestry and land titling programmes. Boxes V and VI describe two such examples.

Box V
Agrarian reform in Brazil

In Brazil, the process of the redistributing and titling of land and the settlement of smallholders has placed emphasis on the sustainable development of small farmers' enterprises and rural areas. Ongoing efforts to establish essential rural infrastructure and to improve access to credits, technical assistance and training are under way.

The national policy for sustainable rural development facilitated the transfer of technology and production systems from successful family farms to the new land reform beneficiaries. Guidelines were elaborated for sustainable development for small family farming and household agriculture. Moreover, institutional capacity in the design and implementation of gender-responsive policies was strengthened and programmes and projects were implemented that reduced or eliminated legislative, administrative, socio-economic and behavioural obstacles to rural women's access to productive resources in the agrarian reform sector.

Source: Instituto nacional de Colonização e Reforma Agrária (http://www.incra.gov.br/).

1. Access to productive resources and poverty alleviation

56. In practice, ownership of land or another form of registered long-term land-use rights is often considered a vital instrument for leveraging resources (in terms of, for example, credit at moderate rates, and water usage rights) which may reduce poverty. In Nicaragua, for example, tenure issues were critical for the successful participation of the poor in the payments-for-environmental-services programmes, which required long-term investments such as adoption of silvo-pastoral practices or reforestation. In Costa Rica, participants in a similar programme were initially required to have land titles; now, poorer land users with non-formal forms of tenure can enter the programme as well.

57. Evidence shows that access to land is one crucial factor that creates enabling conditions to empower poor and marginalized groups. Still in some societies, owing

[40] Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2005* (Rome, FAO, 2005); Leslie Lipper and Dan Osgood, *Dirt Poor: Poverty, Farmers and Soil Resource Investment: Two Essays on Socio-Economic Aspects of Soil Degradation*, FAO Economic and Social Development Paper, No. 149 (Rome, FAO, 2001) (http://www.fao.org/DOCREP/004/Y1796E/y1796e02.htm#P4_0); Klaus Deininger, "Making negotiated land reform work: initial experience from Colombia, Brazil, and South Africa", *World Development*, vol. 24, No. 4 (1999), pp. 651-672; and Partha Dasgupta, "The economics of the environment", *Environment and Development Economics*, vol. 1 (1996), pp. 387-421.

to customary inheritance systems or the legacy of colonization, women and indigenous groups are not entitled to have access to land. Addressing this challenge can contribute significantly to achieving the overarching goal of poverty reduction.

Box VI
Land tenure and environmental services: insights from Nepal and the Philippines

Leasehold forestry in Nepal was designed to achieve the dual goals of poverty reduction and eco-restoration and has been targeted specifically at degraded forest-land areas. Forest leases are awarded to a corporate body, industry or community for a maximum of 40 years, thus being renewable and formalized in a lease certificate. Leaseholds may be granted for the purposes of producing raw materials for forestry industries, selling or distributing forest products from forestation, operating tourism, agroforestry, or maintaining insects, butterflies and wildlife.

Community-based forest management (CBFM) is the cornerstone of the Philippines development strategy, and was adopted formally in 1995 in response to rapid deforestation caused by excessive logging, shifting agriculture and inefficient forest management. The two primary instruments for granting long-term tenure, as adopted by the community-based forest management programme, are the Community-Based Forest Management Agreement and the Certificate of Stewardship Contract.

The tenure programmes of both Nepal and the Philippines resulted in increases in socio-economic and environmental benefits. It should be noted that these programmes were site-specific, depending on the physical and ecological context as well as on proximity to settlements and ease of market access.

Sources: Rural Poverty Portal (http://www.ruralpovertyportal.org/english/learn/forestry/leasehold.htm); and Rodel D. Lasco and Juan M. Pulhin, "Environmental impacts of community-based forest management in the Philippines", *International Journal of Environment and Sustainable Development*, vol. 5, No. 1 (2006), pp. 46-56.

58. Providing the poor and landless with more equitable and secure access to land usually requires changes in policies, legislation and institutions. It requires action at the global and national levels as well as in local communities. One major global recent activity has been the International Conference on Agrarian Reform and Rural Development (ICARRD), held in Pôrto Alegre, Brazil, in 2006,[41] which prepared, inter alia, a proposal for a special initiative on agrarian reform and rural development.

[41] International Conference on Agrarian Reform and Rural Development (ICARRD) (http://www.icarrd.org/).

2. Land titling and registration

59. In Asia and Latin America, there has been some success with land titling and registration (see, for example, boxes V, VI and VII). In Africa, registration programmes have often proved to be slow, expensive and difficult to keep up to date and hard for poor people to access. As a result, very little rural land has been registered, and formal tenure covers only between 2 and 10 per cent of the land.[42] Land registration — through tools and institutions adapted to local conditions — have, in some instances, proved to be a useful component of a broader tenure security strategy, particularly where customary systems have collapsed, where land disputes are widespread, and in newly settled areas. Registration may also be useful in areas of high-value land, such as urban and peri-urban areas and irrigated lands, where competition is particularly fierce. Simple, low-cost and accessible forms of land records and the registration of community land rights are being introduced on an experimental basis in several countries around the world (as exemplified, for example, by the land records in the Niger and the Ethiopian State of Tigray and the community land rights in Mozambique and the Philippines).

60. As a result of this shift in thinking, recent land policies and laws feature important innovations compared with their predecessors. Several countries have made explicit efforts to capture all land rights in records, as reflected, for instance, in protecting customary land rights and providing for their registration (for example, Mozambique, Namibia, the Niger, Uganda and the United Republic of Tanzania). Use or lease rights over State-owned land may also be registered or are otherwise protected (Ethiopia, Mozambique and Viet Nam). In Mozambique, for example, customary use rights are protected regardless of whether formal registration exists. Several recent titling programmes have issued titles not only to individuals but also to families through joint titling for couples (for example, Nicaragua and Brazil) or to groups or communities (for example, South Africa, Mozambique and the Philippines).

61. It is widely recognized that secure tenure does not necessarily require individual titles or landownership. In Viet Nam and China, for example, security has been achieved with clearly defined and sufficiently long-term use rights over land that is ultimately State property. Community land rights can also provide adequate tenure security, provided that group members enjoy clear rights over their plots. In Mozambique, for example, all land belongs to the State, but communities can register a collective, long-term interest and manage land rights according to customary or other local practices. Many countries have adopted national plans of action and established national frameworks to promote women's empowerment. Most constitutions today prohibit gender discrimination and protect women's rights. Legislative reforms have brought about changes in family and succession law directed towards equality between spouses and full legal capacity of married women, and towards greater gender equality in inheritance rights. Moreover, women's legal status has in many countries been improved by judicial decisions declaring discriminatory norms to be unconstitutional.

62. Clear and secure rights for communities or individuals to control and manage land are widely recognized as an important enabling condition for improving

[42] Klaus Deininger, *Land Policies for Growth and Poverty Reduction* (Washington, D.C., World Bank, 2003).

national and household food security and sustainable development. Addressing the challenge of securing land access and land rights is an important factor in poverty reduction and in the creation of sustainable livelihoods.

Box VII
The *doi moi* reforms in Viet Nam

In Viet Nam, the *doi moi* reforms, starting in 1986, allocated cooperative land to farm households, legalized private ownership of productive assets, deregulated agricultural marketing and prices, and devalued the exchange rate. These reforms resulted in better farm-level prices for coffee and stimulated private farmers to expand coffee cultivation. At the same time, many of the State coffee farms began allocating plots to workers, converting them from members of a cooperative to tenants or renters who were responsible for the production of a given parcel of land.

The results of these policy changes resulted, over the period 1986-1996, in an increase of coffee-producing area by almost 21 per cent annually, and an increase in yields per hectare by 6 per cent annually. As a result, coffee production has expanded twelvefold. Coffee exports have come to account for 6-12 per cent of the total value of Vietnamese exports, establishing Viet Nam as the fourth largest coffee exporter.

Source: Nicholas Minot, International Food Policy Research Institute, "Competitiveness of food processing in Viet Nam: a study of the rice, coffee, seafood, and fruit and vegetable subsectors" (Washington, D.C., International Food Policy Research Institute, 19 April 1998).

III. Continuing challenges

63. Land degradation is a global development issue with serious implications for sustainable development. Inaction with respect to conserving land and reversing land degradation results in further land degradation, from which recovery is difficult. Land degradation can be arrested, even reversed, but this requires concerted, long-term investment by all levels of government and by individual land users' supporting more sustainable land management practices. Securing reliable data and adaptation of technologies appropriate to local circumstances are crucial tools for sustainable land management. Effective governance is frequently cited as a crucial factor to improving land planning and management. Building institutional capacity within all levels of Governments remains a challenge.

64. Thus institutional, financial, human and technological capacity present challenges to achieving a more sustainable land management. These challenges hamper the application of existing knowledge, the diversification of land use, in particular of farming systems that mimic natural ecosystems and match local conditions, technological advances, providing payments for ecosystem services, and the promotion of viable initiatives by civil society and the private sector.

65. Conservation agriculture has many positive effects on ecosystem, individuals and society. However, its widespread adoption is mainly constrained by the initial start-up costs and a lack of will to change agricultural systems, particularly in developed countries.

66. Reducing the transaction costs in financing the transition to sustainable land management by simplifying the rules and exploiting economies of scale remains a challenge in the wide-scale adoption of innovative financing mechanisms such as payments for carbon sequestration. Devising methods to effectively monitor and evaluate water service provision of land users, particularly in smallholder agricultural landscapes, remains another challenge.

67. Achieving the ability to enter profitable markets for organically grown food or other niche markets presents significant challenges for producers. These challenges entail the fact that many farms are relatively small in terms of traded volumes and substantial investments are required to develop certification mechanisms and institutions. Securing acceptance for certification in markets, particularly outside the country, presents another challenge.

68. Land tenure issues relating to indigenous peoples are particularly acute in Latin America and in South and South-East Asia. In many areas, indigenous lands are under intense pressure from outside interests — such as incoming agribusiness, timber and mining companies, and large-scale infrastructure projects. In the past decade, however, indigenous groups in many countries have also achieved greater assertiveness and leverage. In several instances, this has led to both political mobilization and legal processes, including litigation before national and international courts. While such lawsuits are not always successful, they do show the extent of civil society mobilization around indigenous lands issues. It remains a challenge to successfully accommodate the interests of new developments while securing the rights of indigenous peoples.

69. Sustainable land management is closely linked to secure land rights, but many Governments are facing difficulties in granting such rights owing to a lack of human capacity and costs involved in land titling. Secure land access not only prevents conflicts, but also empowers local individuals and communities to take actions towards improving land productivity and poverty reduction.

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Review of implementation of Agenda 21 and the Johannesburg Plan of Implementation: drought

Report of the Secretary-General

Summary

Drought has severe adverse implications for sustainable development in affected developing countries and regions, leading to food shortage and food insecurity owing to a drop in agricultural production, famine, water scarcity and loss of human life. The huge dependence of Africa on agriculture renders this continent especially vulnerable to impacts of drought. Climate change is likely to exacerbate frequency of occurrence of drought, with even greater and sustained negative impacts. Current climate scenarios predict that the driest regions of the world will become even drier, signalling a risk of persistence of drought in many arid, semi-arid and dry sub-humid areas, with greater and sustained negative impacts.

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I. Introduction

1. The present report reviews the state of implementation of the goals related to the thematic area of drought, as contained in Agenda 21,[1] the Programme for the Further Implementation of Agenda 21[2] and the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation").[3] The report should be read in conjunction with the reports on desertification, agriculture, land, rural development and Africa, which are also before the Commission on Sustainable Development at its current session.

2. The report draws on substantive contributions from United Nations agencies, in particular the Food and Agriculture Organization of the United Nations (FAO), and on regional assessments prepared by the United Nations regional commissions, in particular the 2007 "Africa Review Report on Drought and Desertification" of the Economic Commission for Africa (ECA).[4] The present report also benefited, in particular, from the United Nations Environment Programme (UNEP) report entitled *Global Environment Outlook: Environment for Development (GEO-4), 2007* and the 2005 *Desertification Synthesis* report of the Millennium Ecosystem Assessment, as well as from country and national assessments submitted by Governments and inputs from major groups.

II. Review of implementation

3. Drought is dealt with in chapter 12, "Managing fragile ecosystems: combating desertification and drought", of Agenda 21 and under chapter IV, "Protection and managing the natural resource base of economic and social development", of the Johannesburg Plan of Implementation. Both chapters address drought in the context of sustainable development. Other chapters of Agenda 21 and the Johannesburg Plan of Implementation, including those on agriculture, land and Africa, also contain drought-related provisions, underscoring the interlinkages between the thematic issues under consideration by the Commission at its current session.

A. Facts and figures on drought

4. Drought is defined as a natural phenomenon that occurs when rainfall is significantly below normal recorded levels over a long period of time. Droughts occur in virtually all climatic zones, but their characteristics and impacts on society vary significantly among regions and countries. The underlying cause of most droughts can be related to changing weather patterns. The impact of drought is exacerbated by activities such as overgrazing and poor cropping methods, which

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janiero, 3-14 June 1992*, vol. I, *Resolutions Adopted by the Conference* (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

[2] General Assembly resolution S-19/2, annex.

[3] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

[4] ECA/FSSD/ACSD-5/3.

reduce water retention of the soil, and improper soil conservation techniques, which lead to soil degradation.

5. The fact that a large share of Africa's economies depend on climate-sensitive sectors, mainly rain-fed agriculture, renders the continent especially vulnerable to impacts of drought. The drought of 1990/1991 in Zimbabwe, for example, resulted in a 45 per cent drop in agricultural production and a drop in GDP of 11 per cent. In Kenya, the drought of 1999-2001 cost the economy some $2.5 billion. The drought of 2002-2003 in the sub-Saharan region resulted in a food deficit of 3.3 million tons, with an estimated 14.4 million people in need of assistance in the subregion.[5]

6. In South-East Asia, Viet Nam has suffered from serious droughts because of climate change during the last decade, with the most serious and longest drought lasting nine months during the dry season of 2004-2005, causing tremendous losses in agriculture and forestry activities.[6]

7. In Central Asia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan have been increasingly affected by drought in the past few decades. Droughts have increased poverty, decreased food security, and caused migration. Furthermore, water stress is expected to worsen in the subregion with the melting of the glaciers and climate change.[7]

8. Drought is recognized as a serious obstacle to the development of the Latin American and Caribbean region, which is facing sharp reductions in rainfall that can lead to situations of famine in the Central American countries. The El Niño phenomenon and its associated effects, such as drought and negative impacts on health, are a recurring and constant threat in the countries of the region.[8]

9. Over the past 30 years droughts have dramatically increased in number and intensity in several European countries. The severe droughts which occurred in South-East Europe during the last decades caused significant socio-economic damage in different sectors; notably, drought-related forest fires were costly for agriculture and loss of human life.[9]

10. Water availability and quality is projected to decrease in many arid and semi-arid regions, with increased risk of droughts and floods. Changing rainfall patterns are likely to further intensify the siltation of rivers and the deterioration of watersheds. For example, lakes and reservoirs in the African Sahel are increasingly threatened to lose part of their water storage capacity, possibly leading to a complete drying. In southern Africa, wetlands of international importance and wildlife are increasingly under threat from drought.

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[5] Economic Commission for Africa, "Follow-up to the implementation of the outcomes of the World Summit on Sustainable Development (WSSD): Regional Review Report Africa", Addis Ababa, November 2007 (ECA/FSSD/07/03), p. 117.

[6] Yang Youlin and Lu Qui, "Challenges and Priority Areas to Implement UNCCD and NAPs of SEA countries", Asia Regional Coordination Unit of UNCCD Secretariat/UNESCAP/ China National Research and Development Centre for Combating Desertification, Chinese Academy of Forestry, p. 66.

[7] Economic Commission for Europe, Regional Implementation Meeting on Sustainable Development, Geneva, 28 and 29 January 2008, Note by the secretariat (ECE/AC.25/2008/3), paras. 37-46.

[8] Economic Commission for Latin America and the Caribbean, Regional Implementation Forum on Sustainable Development, Santiago, Chile, 28 and 29 November 2007, p. 8.

[9] ECE/AC.25/2008/3, para. 41.

11. The projected higher frequency of dry spells might encourage dryland farmers to increase water withdrawals for irrigation. Since sea level rise induced by global warming is likely to affect coastal drylands through salt-water intrusion into coastal groundwater, the reduced water quality in pumped aquifers would further impair primary production of irrigated croplands.[10]

12. Famine has been among the most severe consequences of drought, particularly in Africa. The consecutive droughts that have occurred in southern Africa since 2001 have led to serious food shortages. The drought of 2002-2003 resulted in a food deficit of 3.3 million tons, with an estimated 14.4 million people in need of assistance.[11] The 2007 World Bank and United Nations International Strategy for Disaster Reduction Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa (SSA) Region estimated that food aid to the subcontinent accounts for approximately 50 per cent of the yearly budget of the World Food Aid Programme.

13. The impact of drought on the energy sector is demonstrated by the case of Ghana, where for the first half of 2007 the water level at the Akosombo dam had fallen below the minimum level of 240 feet, leading to a severe reduction in electricity generation from hydropower and hence load-shedding of electricity in the whole country.[12]

14. Recent events associated with climate change, particularly the increasing frequency of droughts notably associated with El Niño, have exerted tremendous pressures on affected communities to further exploit the already degraded and overexploited natural resources. The increasing frequency of El Niño alternating with local drought has created a new and emerging climate pattern called seasonal aridity or periodic drought, where in every other year, the extended dry spell can last as long as six to seven months. This significantly causes severe and long-term damage to soil organic matters and ultimately reduces soil capacity to sustain high crop yields without an increase in external inputs.[13]

B. Drought management

15. The impact of droughts on society depends not only on the severity and duration of the drought, but is also determined by the level of resilience of affected households and communities to drought. Drawing upon a range of studies, a 2004 analysis on drought in the African Sahel prepared by the United Kingdom-based Tyndall Centre for Climate Change Research stated that a resilient society with well-developed coping strategies might survive a severe drought without suffering widespread famine or economic collapse.[14]

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[10] World Resources Institute, *Ecosystems and Human Well-being: Current State and Trends*, chapter 22, "Dryland systems", p. 650.

[11] Economic Commission for Africa, "Africa Review Report on Drought and Desertification (Main report)" July 2007 (ECA/FSSD/ACSD-5/3), p. 14.

[12] ECA/FSSD/ACSD-5/3, pp. 15 and 16.

[13] Yang and Lu, op. cit., p. 13.

[14] Nick Brooks, *Drought in the African Sahel: Long-term Perspectives and Future Prospects*. Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, United Kingdom, Working Paper No. 61, October 2004, p. 9.

16. Similarly, studies conducted in semi-arid areas of sub-Saharan Africa suggest that there is a strong correlation between the ability of farmers to cope with living in marginal, risk-prone environments, on the one hand, and their decisions to invest in particular livelihood strategies, such as agriculture or livestock production, on the other hand.[15]

17. In many developing countries, communities in drought-prone and drought-affected regions have their traditional ways of coping with drought. The central issue for these communities is to implement measures that can further reduce the risks of drought and to minimize the economic and physical damage associated with drought. In the Sahel[r] region of sub-Saharan Africa, for example, livelihood strategies, in particular of smallholder farmers, are primarily geared towards coping with a high degree of uncertainty, risk minimization and meeting subsistence needs, rather than maximizing production and profits, owing to increased aridity of the region.

18. Given the Sahel region's propensity for drought and its dependence on rain-fed agriculture, adaptation to this natural phenomenon is critical. In parts of the Sahelian zones of northern Nigeria and the Niger, for example, successful adaptation to climatic desiccation has been achieved through more intensive but small-scale agricultural practices involving higher livestock densities, soil and water conservation, crop diversification and integrated farm management approaches. Despite reduced rainfall and increased population densities, the communities have been able to manage land productivity and soil fertility in those areas.[16]

Box 1
Drought management in Mauritania

The Tenadi Cooperative Group of Mauritania has worked against a background of years of persistent drought in the Sahel region of Africa that since 1973 has killed 90 per cent of livestock and annihilated the hopes of the nomadic people who have been living there for centuries. In an effort to stop the movement of dunes and solve the problem of drinking water, the Tenadi Cooperative Group has sunk boreholes with immersed pumps and reforested the area around them. Thanks to the Cooperative's activities, a large number of families have chosen to settle around the Tenadi oasis, where they are being trained in new income-generating agricultural techniques, including the introduction of drought-resistant crops.

Source: "Desertification Campaigners Recognized", UNEP News Release 2006/49 — http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=486&ArticleID=5399&l=en

[15] Charlotte Boyd and Cathryn Turton (eds.), "The Contribution of Soil and Water Conservation to Sustainable Livelihoods in Semi-Arid Areas of Sub-Saharan Africa", Agricultural Research and Extension Network, Network Paper No. 102, London, January 2000, p. 2.

[16] Brooks, op. cit., p. 11.

19. In the Southern African Development Community (SADC) subregion, heightened attention is being given to programmes on drought and food security, as a result of frequent droughts that have had devastating impacts on agriculture and food security. Large investments in irrigation have resulted in an area under irrigation that grew from 1.63 million hectares in 1985 to an estimated 1.96 million hectares in 2005. In addition, investments are being made in research and development of drought-tolerant seed varieties. The SADC region has also developed and adopted the Dar es Salaam Declaration on Agriculture and Food Security in the SADC region, which is a regional framework aimed at ensuring food security and reversing chronic food shortage.[17]

20. Many drought-affected developing countries are encountering difficulties in achieving effective integration of drought management plans with national development and budgetary frameworks. Weak institutional structures, lack of technical capacity, limited progress in mobilizing stakeholder participation and investment, and lack of in-depth understanding of the benefits of effective drought management for poverty reduction and economic development are often cited as main constraints to effective integration.

21. There are a number of noteworthy initiatives at the regional and international levels to support effective drought management in affected developing countries The African Drought Risk and Development Network, established with the support of the United Nations Development Programme and the United Nations International Strategy for Disaster Reduction, promotes the development of coordinated strategies for effective drought management at country level. The network has assisted policymakers at national and community levels in addressing drought risks and their implications for development.

22. The Global Environment Facility (GEF) Strategic Priority on Adaptation project is piloting a range of coping mechanisms for reducing the vulnerability of farmers and pastoralists to future climate shocks. Components include piloting coping strategies, improving early warning systems, assisting governments in developing drought management and adaptation plans and integrating climate change/drought across sector policies, and finally replicating and disseminating the results. The project is ongoing in Kenya, Mozambique, Zimbabwe and Ethiopia.[18]

23. Since 2001, the FAO Regional Office for the Near East (FAO-RNE), the International Center for Agricultural Research in the Dry Areas (ICARDA), and the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) have been involved in capacity-building activities such as training courses, workshops and seminars on drought management and have established the Network on Drought Management for the Near East, Mediterranean and Central Asia (NEMEDCA Drought Network). The Network assists in strengthening technical cooperation among concerned national, regional and international organizations in the geographical region covering the Near East, the Mediterranean and Central Asia, particularly in the exchange of information and experience among the member countries and in building capacity on drought management.

[17] ECA/FSSD/ACSD-5/3, pp. 27 and 28.

[18] Martin Krause, "Coping with Drought and Climate Change", Project Inception Meeting, Nairobi, 2005.

1. Introducing climate-resilient crops

24. Informed selection of crop patterns that accounts for seasonal availability and water productivity responses of crops and crop varieties has become an important element of crop management under drought conditions. It is guided by the recognition that drought poses a significant threat to crop production. If farming communities are to adapt successfully to climate change, they will need crop varieties with greater tolerance to stresses such as drought and heat.

25. A report commissioned in 2006 by the United Nations Framework Convention on Climate Change (UNFCCC) entitled "Impacts, Vulnerability and Adaptation to Climate Change in Africa" noted that several national reports, such as those for the Sudan, South Africa and Ghana, mentioned more and better heat- and drought-resistant crops as promising adaptation options for agriculture, food security, and for improving soil productivity. In Zimbabwe, dry-land farmers have switched from maize, which is difficult to grow in persistent drought conditions, to more drought-tolerant and pest-resistant sorghum, and are supplementing this with wetland rehabilitation, goatherding and seed nurseries.[19]

26. Drought reduces global maize yields by as much as 15 per cent annually, representing crop losses of more than 20 million tons of grain. In order to curb those losses, scientists of the Consultative Group on International Agricultural Research (CGIAR), in cooperation with the International Maize and Wheat Improvement Center (CIMMYT), are working with national partners in sub-Saharan Africa to develop drought-tolerant varieties. So far, more than 50 such varieties have resulted from this work, and they are being grown on a total of about one million hectares. In search of further yield gains, CIMMYT scientists are identifying areas of the maize genome that are linked to drought tolerance, with the aid of a molecular genetic map, based on data indicating the performance of different types of tropical maize in diverse environments. Through complementary efforts in the West African savannas, researchers at the International Institute of Tropical Agriculture (IITA) have made significant progress in developing early and extra-early maturing maize varieties that can grow in regions with short rainy seasons.[20]

27. Resulting from the work of the Africa Rice Center and its national partners, drought-resilient rice varieties have been developed that combine the high productivity of Asian rice with the ability of African rice to tolerate harsh growing conditions. Varieties for rain-fed uplands are already being planted on 200,000 hectares and are being tested in 30 African countries.

28. Barley breeders at the International Center for Agricultural Research in the Dry Areas (ICARDA) have demonstrated how drought tolerance in this crop can be markedly improved through a method involving farmer participation. Having first proved successful in the Syrian Arab Republic, the approach is now being applied in seven other countries of the Middle East and North Africa.

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[19] Balgis Osman Elasha, Mahmoud Medany, Isabelle Niang-Diop, Tony Nyong, Ramadjita Tabo and Coleen Vogel, "Impacts, Vulnerability and Adaptation to Climate Change in Africa". Background paper commissioned by the United Nations Framework Convention on Climate Change Secretariat for the African Regional Workshop on Adaptation, Accra, 21-23 September 2006, p. 34.

[20] Consultative Group on International Agricultural Research (CGIAR), CGIAR and Climate Change. Research and Impact: CGIAR on Global Issues (Briefing Dossier, 2007-2008).

29. The International Center for Tropical Agriculture (CIAT) has succeeded in breeding drought-tolerant common beans after nearly a quarter century of research. The new beans yield 600 to 750 kilograms per hectare under severe drought, roughly double the maximum yield that Latin American farmers get from commercial varieties under the same conditions. Bean researchers are actively testing the new varieties in Central America and eastern Africa, while combining their drought tolerance with other traits that farmers need.[20]

30. The United States-based company Pioneer Hi-Bred International, Inc. is developing drought-tolerant corn that uses water sources more efficiently, helping growers to maintain yields during periods of water scarcity. The company is taking multiple approaches that include conventional breeding, molecular breeding and transgenic programmes that might move novel genes into corn. Pioneer also uses a variety of tools, including gene shuffling, which optimizes desired traits by multiplying the effectiveness of beneficial genes.[21]

31. New scientific tools developed by CGIAR scientists are proving to be helpful in accelerating the progress of crop improvement. One of them consists of techniques from molecular biology that enable plant breeders to identify and select genes controlling stress tolerance with far greater efficiency. Such techniques are especially important for successfully transferring desirable traits from wild plants related to crops into commercial varieties of the domesticated species. A second set of tools involves farmer participation in plant breeding, which is highly effective for ensuring that crop improvement takes into account valuable local knowledge and gives results that are truly relevant to local needs and preferences.[20]

2. Coping with water scarcity

32. The central element of drought is water deficit. Projected climate change is expected to intensify the already critical water situation in many drylands. A study from Bristol University projects that areas of western Africa are at most risk from dwindling freshwater supplies and droughts as a result of rising temperatures. Southern Africa, being one of many water-stressed regions, could thus see a further decrease in stream flow and in the ability of groundwater aquifers to "recharge".[22]

33. According to the 2007 ECA "Africa Review Report on Drought and Desertification", projections suggest that by 2025 southern Africa would not have sufficient water resources to maintain its current level of per capita food production from irrigated agriculture — even at high levels of irrigation efficiency — and also to meet reasonable water needs for domestic, industrial and environmental purposes. To sustain their needs, water will have to be transferred out of agriculture into other sectors, making those countries or regions increasingly dependent on imported food.[23]

34. In many countries across sub-Saharan and West Africa, the Middle East, Central and East Asia and Latin America, drought-prone dryland communities have

[21] "Desertification Campaigners Recognized", UNEP News Release 2006/49 — http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=486&ArticleID=5399&l=en.

[22] ECA/FSSD/ACSD-5/3, pp. 6 and 7.

[23] Ibid., p. 16.

developed traditional water-harvesting methods to support farmers' adaptation to drought and to provide water and nutrients to crops and trees.[24]

35. Traditional water-harvesting techniques called "zai" and "demilunes" are used in West Africa after the recent drought period in order to concentrate and make more effective use of rainwater and to enhance the reliability of agricultural production. Water harvesting is gaining increasing attention in western Sudan, where results are very encouraging for improving agricultural production and livelihoods. Farmers in Mali and the Niger obtained spectacular results through improved "zai"/"tassa" planting pits that catch more of the sparse rainfall and to which dung/compost is added, for more efficient use of plant nutrients and moisture.

36. Run-off water from adjacent catchments channelled to underground rainwater reservoirs (cisterns) remains an important source of water, e.g., in drylands of Jordan, the Syrian Arab Republic and Egypt. The collected water is mainly kept for human and animal consumption, but is sometimes also used to irrigate vegetables and fruits in domestic gardens. "Hafaers", also called "khadens", are earthen surface ponds created by herders to water livestock. They can, for example, be found across the Middle East and in India. Rooftop-water harvesting provides low-cost water for drinking and household uses for dryland communities in Latin America, the Middle East and sub-Saharan Africa.[25] Ancient underground water distribution systems ("qanat") allowing specialized and diverse cropping systems are used in the Islamic Republic of Iran, Afghanistan and other Central Asian countries, with associated home gardens and endemic blind fish species living in underground waterways.

37. Maintaining residue crops to retain soil moisture (reduced evaporation; wind and water erosion) is a practice that has proven effective, even under low rainfall conditions (200-350 mm/year). An example from the north of the United Republic of Tanzania showed increased rainwater productivity of 200-300 per cent. Even in years with 400 mm or less of rainfall, farmers harvested maize yields of about 2 tons/ha while maize crops failed in neighbouring conventional systems. Restoration of soil organic matter is also vital to increasing soil moisture retention and water-use efficiency. Both cover and organic matter are used in conservation agriculture systems.

38. There is scope for improving rain-fed agriculture, including through better efficiency in rainwater-harvesting and -management. GEO-4 noted that established, though incomplete, evidence suggests that two thirds of the necessary increase in production needed from rain-fed farming can be achieved through better rain-use efficiency. Analysis of more than 100 agricultural development projects found a doubling of yields in rain-fed projects compared with a 10 per cent increase for irrigation.[26]

39. With its "Programmatic Approach to Water Use Efficiency and Agricultural Productivity", FAO intends to provide a framework for coping with water scarcity in general and with drought in particular. The framework uses an integrated demand-

[24] Food and Agriculture Organization of the United Nations, 2004, "Drought-resistant soils: optimization of soil moisture for sustainable plant production" (Synthesis report of the FAO electronic conference).

[25] Theib Oweis, "Improving access to water in deserts and drylands", Policy Briefs, Science and Development Network, October 2006, p. 2.

[26] UNEP, *Global Environment Outlook: Environment for Development* (GEO-4), Valetta, Malta, 2007, p. 136.

supply approach. The demand-side approach aims at managing the demands for water use in agriculture, with the objectives of improving water use efficiency and agricultural productivity, farm water management, irrigation system performance and adjustments of national water and irrigation policies. The supply-side approach aims at managing conjunctively the use of surface and groundwater, reuse of wastewater and drainage water, and desalination, where appropriate.

3. Index-based weather insurance

40. As a major share of agricultural production in many developing countries is based on rain-fed agriculture, production is highly susceptible to extreme, uncontrollable weather events such as drought, in terms of both quality and yield of crops. Consequently, drought has become an important risk factor in investment decisions of both agricultural producers and financial institutions working with farmers, making it necessary to develop and use investment schemes that would include drought in financial risk management.

41. Index-based weather insurance represents an emerging innovative market scheme for managing risks associated with drought. Rather than simply insuring against crop failure, as traditional agricultural insurance contracts do, index-based weather insurance contracts are written against an index that describes an established relationship between, for example, lack of rainfall and crop failure. In case the amount of rainfall is below an agreed trigger point, the farmers receive payouts. The scheme also bundles insurance with a loan for the purchase of seeds and fertilizer.[27]

42. Index-based weather insurance schemes are being piloted in Ethiopia and Malawi, which are expected to demonstrate the viability of insuring extreme risks, such as drought, and enhance farmers' access to finance. Mozambique's policy strategy also encourages people to adopt risk insurance mechanisms and other preventive or mutual assistance instruments, while Namibia's National Drought Policy and Strategy promotes on-farm risk management.[28]

C. Early warning and climate and weather information

43. There is increasing recognition that the establishment and effective operation of systems and networks for drought monitoring, early warning and drought impact assessment are essential to the identification and formulation of effective and timely response actions.

44. Responding to the need for long-term drought mitigation planning for effective and proactive drought management, a number of initiatives have been taken. Under the European Commission-funded Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN) project, for example, a framework for a timely

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[27] Hellmuth, M. E., Moorhead, A., Thomson, M. C., and Williams, J. (eds.), *Climate Risk Management in Africa: Learning from Practice* (Policy Brief), International Research Institute for Climate and Society, Columbia University, New York, 2007; Erin Bryla and Joanna Syroka, "Developing Index-Based Insurance for Agriculture in Developing Countries", Sustainable Development Innovation Briefs, Issue 2, United Nations Department of Economic and Social Affairs, March 2007.

[28] ECA/FSSD/ACSD-5/3, p. 32.

implementation of drought mitigation measures has been developed. Regional drought monitoring systems have been established, including the Regional Early Warning System of the Southern African Development Community (SADC) established by the Intergovernmental Authority on Development (IGAD) in the Horn of Africa and the West African Permanent Interstate Committee on Drought Control in the Sahel (CILSS) and its Regional Training Centre for Agrometeorology and Operational, Hydrology and their Applications (AGRHYMET).

45. Though some progress has been made to improve the number and the capacities of existing drought monitoring and early warning systems, the general situation in many drought-prone regions remains far from satisfactory.

46. A major weakness of drought monitoring and crop forecasting is the lack of accurate and updated climate and weather information. The ability of meteorological stations to deliver such information has been eroding in many countries over the last decades or so, making impact assessments more uncertain in the face of the increasing frequency of constraints on agricultural production systems. Of particular relevance is the improvement of seasonal forecasts, i.e., forecasts beyond the reach of traditional weather forecasts that typically do not exceed 10 days.

47. As demonstrated by the experience of several developed countries, a better understanding of the longer term mechanisms of climate variability, such as El Niño, has the potential to avert the most serious impacts of droughts and floods when coupled with impact simulation models. Although some initial work has been done on the subject in developing countries, the potential of the approach is such that significantly more efforts in this direction are needed.

48. Space-based technologies and their applications, such as Earth observation systems, meteorological satellites, communication satellites and global navigation satellite systems, are increasingly being used to support the monitoring and assessment of the environment, managing the use of natural resources, supporting early warning systems and disaster management activities and contributing to providing education and health services in rural and remote areas.

49. Regional and interregional cooperation and coordination contribute to increased access to space-based technologies and their applications. The United Nations Platform for Space-based Information for Disaster Management and Emergency Response, for example, which was recently established by the General Assembly (resolution 61/110) as a programme for the United Nations Office for Outer Space Affairs, works towards providing all countries and all relevant international and regional organizations with universal access to all types of space-based information and services relevant to disaster management. Similarly, the intergovernmental Group on Earth Observations (GEO) is leading a worldwide effort to build a Global Earth Observation System of Systems (GEOSS) over the next decade. GEOSS will build upon existing national, regional and international systems to provide comprehensive, coordinated Earth observations from thousands of instruments worldwide, transforming the data they collect into vital information for society.

1. Early warning systems and tools

50. Early warning has a crucial role in decision-making and capacity-building on issues related to drought mitigation. Designed to detect the emergence or probability

of occurrence and the likely severity of drought, a well-functioning early warning system allows more effective management of the risks associated with drought and helps to build up the drought-preparedness capacity of affected communities. Early warning systems can be of great support in the formulation of preparedness plans and contingency arrangements if they are easily accessible and the information provided is up to date, accurate and available in a timely fashion. Some examples of existing early warning systems at the country level are provided in box 2.

Box 2
Early warning systems: some country examples

Droughts occur frequently in Ethiopia, where widespread poverty increases people's vulnerability, leading to food insecurity. The country has responded with the establishment of an early warning system to facilitate adopting mitigation before disaster strikes. The system has evolved into a complex information and monitoring system that gathers data from multiple sources and provides information to a large number of users. There are early warning committees at all levels of the government. The effectiveness of the system was demonstrated in 2003, when more that 13 million Ethiopians were affected by drought, but a major famine was avoided.

An early warning system is part of Kenya's Arid Lands Resources Management Project to assist government agencies in taking timely and well-informed response measures. Drought-relevant information is also made widely available to herders and farmers, who may use it in their individual management decisions, thus improving their preparedness for drought.

Syria, with the assistance of FAO, established an early warning system for drought, with particular emphasis on pastoralists and agro-pastoralists of the Syrian Steppe and its margins. The system has been fully operational since 2006.

The United States Agency for International Development (USAID) Famine Early Warning System Network (FEWS-NET) has developed national capacities for disaster prevention and early warning for food security. FEWS-NET adopts a national level "livelihood zoning" approach allowing for better understanding of vulnerability to shock and better preparedness and response to droughts and other emergencies.

Zambia's Early Warning System has facilitated the adoption of measures at the national level where drought has occurred. However, even though there has been regular collection of rainfall data and regular forecasting, there has reportedly been little utilization of that information by most decision makers because the information appears complex.

51. The seriousness of drought and its impacts on land degradation and livelihoods in affected areas prompted the Government of Indonesia to initiate efforts for the development of an early warning system. Monitoring and assessment of land

degradation attributed to drought and climate change are intended to be based on indicators such as increasing frequency of forest/bush fire, spreading areas of withered plants owing to drought, disappearance of water wells and natural springs, declining livestock population, increased rate of harvest failure, and increased areas of abandoned land. Once fully operational, the early warning system is supposed to offer quality service to both government and communities and to serve information-sharing at ministry and local levels in mitigating the effects of drought and land degradation.[29]

52. Over the years, a number of analytical tools have been developed to collect, analyse, present and disseminate information, making full use of modern information and communication technologies as well as sources of data, such as satellite remote sensing. Of particular interest is the FAO-developed set of crop yield forecasting tools known as the AgrometShell (AMS).

53. AMS is used to assess the impact of weather conditions on crops and is based on statistical and crop-modelling approaches. It is a collection of tools for the integrated analysis of ground data and low-resolution satellite information, which have been brought together under a common interface. AMS is built around a database of crop, weather and climate data that is used to compute a crop-specific soil water balance and to derive some agronomic/agro-meteorological value-added variables (indicators) used to assess crop conditions. The software includes tools to integrate data at different spatial scales, such as weather stations (points), agricultural statistics (regions) and satellite imagery about vegetation indices and rainfall (pixels).

2. Climate and weather information networks

54. There is increasing awareness of the importance of access to climate and weather information in the context of drought preparedness and early warning. Although a network of climate and weather observation systems exists at the international level, this is often not complemented by compatible systems at regional, subregional and country levels, in particular in Africa. Addressing this issue, the report of the 2006 UNFCCC African Regional Workshop on Adaptation highlighted the urgent need for upgrading the climate and weather observation stations and networks in Africa and indicated a requirement for about 200 weather stations to support provision of services specifically related to droughts and other Africa-relevant climatic phenomena.[30]

55. In an effort to minimize the negative effects of drought and floods in the Greater Horn of Africa, the Climate Prediction and Applications Centre located in Nairobi was established, with the support of the World Meteorological Organization and the United Nations Environment Programme. The participating countries are Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, the Sudan, Uganda and the United Republic of Tanzania. The Centre monitors intensity, duration and geographical extent of droughts and their impact on agricultural production and issues early warnings in the Greater Horn of Africa.[31]

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[29] Yang and Lu, op. cit., p. 13.

[30] Balgis Osman Elasha et al., op. cit., p. 9.

[31] "Drought monitoring and early warning: concepts, progress and future challenges", World Meteorological Organization, Geneva, 2006, p.17.

56. The Climate for Development in Africa programme is being developed, under the auspices of Global Climate Observing System and in collaboration with the Economic Commission for Africa, to guide the effective integration of climate information and services into development planning for Africa and to ensure the mainstreaming of climate considerations in achievements of the Millennium Development Goals.

57. Regional Climate Outlook Forums are convened annually by the World Meteorological Organization in the Greater Horn of Africa, in South Africa and in West Africa, to elaborate and ensure appropriate dissemination of consensual regional outlooks, bulletins and products about the next rainy season. These outlooks are directed towards the needs of users from agriculture, health, water management and energy, based upon their input and feedback.[32]

III. Continuing challenges

58. The impact of projected climatic changes, for example, a decrease in precipitation and a rise in temperature, is likely to further exacerbate the frequency and severity of droughts, with adverse impacts on food production and food security, in particular in Africa. The challenge is to reduce the vulnerability of the agricultural sector — including the risks to regional and global food supplies — to climate variability and the projected changes in extreme weather events, including droughts, heatwaves and floods.[33]

59. Where millions of the world's poorest and marginalized people rely on mostly rain-fed agriculture for their livelihoods, lack of resilience to droughts is a significant barrier to agricultural production and food security. As stated in the Secretary-General's note to the High-Level Event on Climate Change, "An immediate task in strengthening communities' resilience is preparing for more extreme weather conditions through disaster risk reduction programmes, for example to strengthen public risk awareness, early warning and disaster preparedness."[34]

60. As droughts may become more frequent and severe in nature, competition for water resources will likely increase, raising the risks of conflicts over water supplies and access to water. Water-sharing agreements between countries that share freshwater bodies will likely gain importance in the search for practical options to ensure equal access to water, while avoiding potential water conflicts.

61. Improved access to appropriate and affordable technologies and related field training and capacity-building to grow climate-resilient crops have proven to be important in maintaining soil productivity and increasing food production in drought-affected drylands.

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[32] E/ECA/ACSD/5/9, pp. 16 and 17.

[33] Discussion papers of major groups submitted to the Commission on Sustainable Development at its sixteenth session: contribution by the scientific and technological community (E/CN.17/2008/13/Add.8).

[34] "The future in our hands: addressing the leadership challenge of climate change. Background note by the Secretary-General to the High-Level Event on Climate Change", 24 September 2007, p. 3.

62. The projected persistence and severity of droughts underscores the urgency of gradually shifting priority in drought management of affected countries and regions from essentially sector-specific strategies and policies (agriculture, energy, water, forestry, etc.) to those that integrate management of natural resources and ecosystems with social and economic development strategies and action plans.

63. Moving to a proactive, risk-based approach in drought management has proven to be effective in preventing or reducing the physical or economic losses associated with drought. Taking a proactive approach to drought management is even more urgent under the scenarios for climate change. It is of particular significance to regions such as the Sahel, West Asia and the Mediterranean, where population growth and urbanization now expose many more people to the impacts of drought.

64. Inadequate financial resources and technical capacities often hamper the implementation of programmes and projects on drought risk management through, for example, education and field training and the exchange of experience and best practices.

65. Though there is increasing recognition of the crucial role that systems and networks for drought monitoring, early warning and drought impact assessment can play in drought mitigation, in many drought-affected developing countries and regions such systems and networks are not available or, where they are available, often do not effectively operate.

66. There is a lack in the systematic collection and analysis of drought-relevant data (e.g., occurrence, frequency and severity) in many affected countries, which is a constraint to fully understanding drought characteristics, hampering the ability to effectively undertake drought impact assessments (e.g., susceptibility of crops; impact of projected climate change on land productivity and water resources; and social impacts).

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Review of implementation of Agenda 21 and the Johannesburg Plan of Implementation: desertification

Report of the Secretary-General

Summary

Desertification is a global issue, with serious implications for worldwide eco-safety, poverty eradication, socio-economic stability and sustainable development. Measured by indicators of human well-being and development, including gross national product per capita, access to clean drinking water and adequate sanitation, and infant mortality, dryland people — about 90 per cent of whom live in developing countries — lag far behind the rest of the world. Poor people living in dryland areas have to contend with multiple challenges of income loss, food insecurity, weakening health, insecure land tenure systems and access rights to natural resources, and lack of access to markets. Poor livelihood opportunities often force them to migrate to areas not affected by desertification in the search for a better life. The increased frequency and severity of droughts resulting from projected climate change is likely to further exacerbate desertification. In this regard, the United Nations Convention to Combat Desertification offers a platform for adaptation, mitigation and resilience.

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I. Introduction

1. The present report reviews the state of implementation of the goals related to the thematic area of desertification, as contained in Agenda 21, the Programme for the Further Implementation of Agenda 21 and the Johannesburg Plan of Implementation. The report should be read in conjunction with the reports on drought, agriculture, land, rural development and Africa, which are also before the Commission on Sustainable Development at its current session.

2. The report draws on substantive contributions from United Nations agencies, in particular, the Food and Agriculture Organization of the United Nations (FAO) and on regional assessments prepared by the United Nations regional commissions, in particular, the 2007 Africa Review Report on Drought and Desertification of the Economic Commission for Africa (ECA). The report also benefited, in particular, from documentation of the United Nations Convention to Combat Desertification, *Global Environment Outlook: Environment for Development (GEO 4), 2007*, a report of the United Nations Environment Programme (UNEP) and the 2005 *Desertification Synthesis* report of the Millennium Ecosystem Assessment, as well as from country and national assessments submitted by Governments and inputs from major groups.

II. Review of implementation

3. Desertification is dealt with in chapter 12, "Managing fragile ecosystems: combating desertification and drought", of Agenda 21 and under chapter IV, "Protecting and managing the natural resource base of economic and social development", of the Johannesburg Plan of Implementation. Both chapters address desertification in the context of sustainable development, recognizing that desertification is not just a change of ecosystems, but has far-reaching social and economic implications. The goals on desertification, as contained in Agenda 21 and the Johannesburg Plan, clearly underscore the interlinkages between desertification and the other thematic issues under consideration by the current session of the Commission on Sustainable Development.

A. Facts and figures on desertification

4. Desertification is defined by the United Nations Convention to Combat Desertification as land degradation in drylands resulting from various factors, including climate variations and human activities. According to the GEO 4 report, some 2 billion people depend on ecosystems in dryland areas, 90 per cent of whom live in developing countries. Worldwide, more than 30 per cent of the total land area is dryland. About 30 per cent of drylands are degraded, with particular susceptibility to desertification. Globally, 20,000 to 50,000 square kilometres are lost annually through land degradation, chiefly soil erosion, caused by unsustainable land management practices and climate change, with losses two to six times higher in Africa, Latin America and Asia than in North America and Europe.[1]

[1] United Nations Environment Programme, *Global Environment Outlook: Environment for Development (GEO 4)*, Valletta, 2007, pp. 83 and 95.

5. Continued deforestation and forest degradation has aggravated land degradation, reduced water availability and accelerated loss of vegetation. Inefficient water use in irrigated agriculture has increased pressure on freshwater bodies and groundwater resources in dryland areas. Unchecked falls in water tables and increased salinity have reduced water availability and water quality, with far-reaching implications for human health, land productivity, agricultural and animal husbandry development, and biodiversity.

6. Across Africa, drylands vulnerable to, or affected by, desertification occupy about 43 per cent of the region. The most common processes of land degradation eventually leading to desertification are soil erosion, soil nutrient depletion, contamination of soils and salinization. The biggest impact of land degradation is on agriculture, which is the dominant land use in Africa and the biggest employer.[2] Two thirds of arable land is expected to be lost in Africa by 2025 and land degradation currently leads to the loss of an average of more than 3 per cent of agriculture gross domestic product annually in sub-Saharan Africa. If land degradation continues at the current pace, it is projected that more than half of the cultivated agricultural area in Africa could be unusable by the year 2050 and the region may be able to feed just 25 per cent of its population by 2025.[3]

7. In terms of the number of people affected by desertification and drought, Asia is the most severely affected continent. Desertification is manifested in many forms across the region. Degraded areas are found in most countries, with prominent examples including China, India, the Islamic Republic of Iran, Mongolia and Pakistan, the steeply eroded mountain slopes of Nepal and the deforested and overgrazed highlands of the Lao People's Democratic Republic.[4]

8. Roughly 65 per cent of West Asia's land base is drylands prone to land degradation and desertification. Soil erosion and salinization of soils constitute the major threats to land degradation and desertification in West Asia, with as much as 1.5 million square kilometres — one third of the region — affected. In extreme cases, mobile dunes encroach upon farmland and settlements. Frequently affected by drought, West Asia is one of the most water-stressed regions in the world.

9. Indonesia and Cambodia are among the countries of South-East Asia that have experienced severe land degradation. In Cambodia, approximately 50 per cent of all cultivated land is estimated to be exposed to soil erosion, leading to severe loss in soil fertility. In Indonesia, about 2.4 million hectares, accounting for roughly 35 per cent of the total land area, is degraded, while about 1 million hectares, accounting for roughly 15 per cent of the total land area, is classified as being extremely degraded.[5]

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[2] Ibid., p. 205.

[3] Economic Commission for Africa, Follow-up of the Implementation of the Outcomes of the World Summit on Sustainable Development (WSSD), Addis Ababa, November 2007, p. 117.

[4] Economic and Social Commission for Asia and the Pacific, Report of the Regional Implementation Meeting for Asia and the Pacific for the Sixteenth Session of the Commission on Sustainable Development, Jakarta, 26-27 November 2007, annex, para. 3.

[5] Yang Youlin and Lu Qui, "Challenges and Priority Areas to Implement the United Nations Convention to Combat Desertification in South-East Asian Countries". Asia Regional Coordination Unit of the UNCCD secretariat/Economic and Social Commission for Asia and the Pacific/China National Research and Development Centre for Combating Desertification, Chinese Academy of Forestry, p. 7.

10. In East Asia, China is experiencing severe desertification over a vast area. According to the 2006 China National Report on the Implementation of the United Nations Convention to Combat Desertification and National Action Programme to Combat Desertification, the area of desertification accounts for about 28 per cent of the total territory, while the area prone to desertification is estimated to account for roughly 35 per cent of the country's territory.[6]

11. In Central Asian countries, more than half of the land is highly susceptible to desertification and land degradation, and is already highly affected. Given that the majority of the Central Asian population lives in rural areas, the impact of land degradation is taking a high toll on the quality of life.[7]

12. In Latin America and the Caribbean, rising levels of land degradation and desertification affect large areas of the region and threaten food security.[8] Desertification is estimated to affect some 25 per cent of the territory, mainly caused by deforestation, overgrazing and soil erosion. Salinization of agricultural soils owing to irrigation is particularly significant in countries such as Argentina, Cuba, Mexico and Peru, which have extensive dryland areas.[9]

13. The effects of desertification extend beyond the affected dryland areas. Reduction of vegetation cover, for example, increases the formation of aerosols and dust. This, in turn, affects cloud formation and rainfall patterns, the global carbon cycle and plant and animal biodiversity.[10] Combating land degradation and desertification has implications for addressing critical issues of global interest, such as migration, conflict prevention, natural disasters and climate change.

14. Desertification affects global climate change through soil and vegetation losses. Dryland soils contain over a quarter of all of the organic carbon stores in the world and nearly all the inorganic carbon. Unimpeded desertification may release a major fraction of this carbon to the global atmosphere, with significant feedback consequences for the global climate system. It is estimated that 300 million tons of carbon are lost to the atmosphere from drylands as a result of desertification each year (about 4 per cent of the total global emissions from all sources combined).[11]

15. Climate change may adversely affect biodiversity and exacerbate desertification risks in many areas owing to the increase in evapotranspiration and a likely decrease in rainfall in drylands. However, since carbon dioxide is also a major resource for plant productivity, water-use efficiency will significantly improve for some dryland species that can favourably respond to increasing carbon dioxide and temperatures.[12]

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[6] China National Committee for the Implementation of the UNCCD (CCICCD), China National Report on the Implementation of the United Nations Convention to Combat Desertification, Beijing, June 2006, p. 5.

[7] ECE/AC.25/2008/3, para. 51.

[8] Economic Commission for Latin America and the Caribbean, Regional Implementation Forum on Sustainable Development. Santiago, 28-29 November 2007.

[9] United Nations Environment Programme, *Global Environment Outlook: Environment for Development (GEO 4)*, Valletta, 2007, p. 247.

[10] *Ecosystems and Human Well-Being: Desertification Synthesis*. Millennium Ecosystem Assessment, 2005, World Resources Institute, Washington, D.C., p. 8.

[11] Ibid., p. 18.

[12] Ibid.

B. Land use and livelihoods

16. The correlation between land use, land productivity and livelihoods is particularly evident in the world's drylands. Land degradation resulting from both natural causes and unsustainable land use practices is felt more quickly and severely in regions with poor quality land, which is characterized by salinity, erosion and nutrient depletion. The table below highlights the links between desertification, environmental impact and human well-being.

Table 1
Links between desertification, environmental impact and human well-being

Change in land	*Environmental impact*	*Material needs*	*Human health*	*Safety*	*Socio-economic*
Desertification	Loss of habitat and biodiversity Reduced groundwater recharge, water quality and soil fertility Increased soil erosion, dust storms and sand encroachment	Diminished farm and rangeland production Loss of biodiversity Water scarcity	Malnutrition and hunger Water-borne diseases, respiratory problems	Conflict over land and water resources Dust hazards	Poverty, marginalization, decreased social and economic resilience, migration

Source: United Nations Environment Programme, *Global Environmental Outlook: Environment for Development (GEO 4)*, Valletta, 2007, p. 120, table 3.3 (extract).

17. Population growth and increased food demands are driving the trend towards sedentary agriculture and farming in drylands, leading to growing tensions between the two main land uses: pastoral rangeland and cultivated land use.

18. In addressing this issue, the aforementioned *Desertification Synthesis* report found that, in some areas, intercultural conflicts and desertification have increased as herders and farmers claim access to and use of the same land; in other areas, Government policies and favourable market opportunities have resulted in increased integration of pastoral and agricultural land uses, thus providing an environmentally sustainable way to avoid desertification.

19. The intensification and expansion of agricultural activities have caused significant reduction in dryland ecosystem resilience, rendering many of them increasingly vulnerable to land degradation and desertification. Conservation agriculture to sustain and enhance agricultural production through the integrated management of locally available soil, water and biological resources, combined with cost-effective use of external inputs, has been widely adopted by small- to large-

scale farmers in drylands of Latin America, North America, Australia and Central Asia, and is expanding in parts of Africa.

20. More recently, there has been a shift from soil fertility management towards a more holistic approach that considers soil fertility management in the broader context of natural resource management. The shift takes account of an important lesson that farmers have learned, namely, that effective decisions on soil fertility are not merely driven by soil and climatic factors but also by the full range of driving factors and consequences of soil degradation — biological, chemical, physical, social, economic, health, nutritional and political.

21. While rangelands have proven to be resilient under traditional mobile grazing practices in response to seasonal changes, reduced mobility, owing to the extension of cultivated land, has led to increased pressure on remaining rangelands, contributing to their degradation.[13] New grazing strategies are being practiced in order to improve range productivity and quality. An example is provided in box I.

Box I
Thuo-Boswa Land Care Cattle Project

Owing to uncontrolled grazing, the rangelands around the Thuo-Boswa village in South Africa became degraded, rendering cattle farming unprofitable and unsustainable. With technical and financial support from the provincial government, farmers established a livestock grazing management system with fenced paddocks and reticulated water systems. As a result of the project, the calving percentage increased from less than 50 per cent to more than 80 per cent. Climax grasses have increased in abundance in the grazing paddocks and the overall status of the grazing resources has reportedly improved since the initiation of the project.[14]

22. Integrated crop-livestock farming systems have been developed in the Sahel region using community-based approaches, which has resulted in the improved cycling of nutrients between rangelands and crop land, and between ruminant livestock and the soils.

1. Soil and water conservation

23. Soil and water conservation has been implemented mostly at the community level, drawing upon the wealth of knowledge and experience that has been accumulated in local communities in their interaction with nature over time. Government interventions were supportive in policy areas where they acted as incentives to community investments in soil and water conservation. Some examples of soil and water conservation at the country level are provided in box II.

[13] Ibid., p. 6.

[14] Africa Review Report on Drought and Desertification (main report). Economic Commission for Africa, July 2007, p. 26 (ECA/FSSD/ACSD-5/3).

Box II
Soil and water conservation: some country examples

Farmers in Burkina Faso rescued their fields from imminent desertification by erecting low stone walls along the contours of hillsides to keep soil and water on the land.

Support provided to small farmers in Cape Verde has led to the introduction of new irrigation technologies and improvements in fodder recovery and seed launches in pastoral farming areas. Moreover, maize cultivation on slopes in high-altitude areas, which causes severe land degradation, is gradually being replaced by higher-yield horticulture crops, which are grown using techniques that cause less soil erosion.

In India, the introduction of soil conservation technologies and techniques, such as timeliness and precision in sowing crops, contour farming and use of low-to-moderate levels of inputs with improved seeds, has helped to improve the use of natural soil fertility and available moisture, contributing to crop growth. The introduction of a legume component in the cropping system has provided much-needed nitrogen.

Source: *Implementing the United Nations Convention to Combat Desertification in Africa: Ten African Experiences*, United Nations Convention to Combat Desertification, Bonn, Germany, 2006, p. 32; Jagarlapudi Venkateswarlu, Sustainable Agricultural Systems for the Development of Arid and Semi-Arid Areas in India. In: Advanced Technology Assessment System, issue No. 7, United Nations, New York, 1992, pp. 139-142.

24. A research study carried out by the United Kingdom Department for International Development-sponsored Agricultural Research and Extension Network on soil and water conservation in semi-arid areas of sub-Saharan Africa, which based its analysis on case studies from Burkina Faso, Senegal, Ghana, Nigeria, Uganda and the United Republic of Tanzania, found that decisions to invest in soil and water conservation are, in some cases, driven by policies and institutional structures that are beyond the immediate control of households; in other cases, they appear to depend heavily on endogenous social, cultural and agro-ecological conditions which are not easily influenced by external interventions.[15]

25. The case studies found that more than 50 per cent of surveyed farmers who had not invested in soil and water conservation attributed their decisions primarily to weak and inefficient extension services, lack of access to fertilizers, tools and seeds, and lack of access to financial capital as well as to markets where farmers can sell their produce at competitive prices.[16]

[15] Charlotte Boyd and Cathryn Turton (ed.), The Contribution of Soil and Water Conservation to Sustainable Livelihoods in Semi-Arid Areas of Sub-Saharan Africa. Agricultural Research & Extension Network (AgREN), Network Paper No. 102, London, January 2000, p. 1.

[16] Ibid., p. i (abstract).

2. Tenure security and access to markets

26. Tenure insecurity and unclear access rights to water and other natural resources are among the main reasons for the unwillingness of land users to invest in sustainable land management. In Uganda, for example, insecurity of land tenure in parts of the cattle corridor under communal land ownership systems does not encourage farmers to invest in sustainable land management practices, as noted in the 2007 Africa Review Report on Drought and Desertification.[17] Case studies from Burkina Faso, the Niger and Senegal reported by FAO suggest that without secure land rights, farmers have little or no access to credit, rural organizations and other agricultural inputs and services. In Jordan, on the other hand, the allocation of tribal land to individual Bedouins increased property values and provided the incentive to harvest water.

27. According to the GEO 4 report, more attention is now being given in Africa to the inclusion of customary tenure in national land administration laws to protect people's customary land rights. Innovative tools to both improve tenure security for the poor and to address land degradation problems include occupancy licences, customary leases and certificates. However, such tools also present problems. For example, in Zambia, registration of customary land often leads to denial of other customary rights, while in Uganda, the pace of issuing certificates has been slow, with no certificates issued since 1998.[18]

28. Some countries in West Africa have developed Pastoral Codes — framework laws which enable pastoral communities to establish jurisdiction over home territories, obtain freedom of movement in cattle corridors and negotiate access to more extensive grazing and water resources under the primary jurisdiction of other groups, on which they rely in the dry season.[19]

29. In China, the National People's Congress passed the Law on Combating Desertification. The law sets out basic guidelines, responsibilities and obligations, a management system, guarantee measures and the legal consequence of violating the law.[20]

30. In several countries with economies in transition, new laws on land ownership provide new opportunities to address land degradation issues.[21]

31. Lack of access to markets, which constrains the ability of farmers to buy agricultural and farming inputs and sell their produce, remains a barrier to economic growth and sustainable livelihoods in many drylands. Past efforts to improve market access have often not worked because of a failure to deal in an integrated fashion with all of the elements that must come together: Government investment in infrastructure; incentives for the private sector to invest in agriculture and livestock

[17] Africa Review Report on Drought and Desertification (main report). Economic Commission for Africa, July 2007, pp. 33-34.

[18] United Nations Environment Programme, *Global Environment Outlook: Environment for Development (GEO 4)*, Valletta, 2007, p. 213.

[19] E/ECA/ACSD/5/9, pp. 9-10.

[20] China National Committee for the Implementation of the UNCCD (CCICCD), China National Report on the Implementation of the United Nations Convention to Combat Desertification, Beijing, June 2006.

[21] Draft report of the fifth session of the Committee for the Review of the Implementation of the United Nations Convention to Combat Desertification, held in Buenos Aires from 12 to 21 March 2007, p. 28 (ICCD/CRIC(5)/L.1).

production; and capacity-building for the users of markets. In addition, global trade regimes, in particular, agricultural subsidies and tariff barriers, are affecting the incomes and competitiveness of dryland producers in developing countries.

C. Conservation of dryland vegetation

32. The natural vegetation is critical to the economic and biological productivity of ecosystems upon which dryland people depend. Dryland vegetation is often fragile and more vulnerable to climatic variations and unsustainable human activities than non-dryland vegetation. Lower rainfall resulting from drought reduces soil moisture and vegetation cover and induces further degradation in the services dryland ecosystems provide. Local communities, especially poor families, are often compelled to seek their survival by overexploiting the ecosystems of drylands, such as overgrazing and massive conversion of forests and grasslands to arable lands, thereby further increasing areas affected by desertification.[22]

33. In many semi-arid drylands, a progressive shift from grassland to shrubland has taken place, encouraging increased runoff velocity and resulting in higher soil erosion rates.[23] This process, known as bush encroachment, has, for example, been observed in Africa, Australia and the western United States.[24]

34. Reduction of vegetation cover has increased the formation of dust leading to dust storms, which are widely considered to be a cause of ill health during dry seasons.

1. Rehabilitation of grasslands

35. In China, the system of grassland-contracted responsibility is being practised in most pastoral areas. On the basis of public ownership, grassland has been divided among households under contracted responsibility and household livestock-raising is being supported. From 2002 to 2005, the Government of China invested over Y8 billion in the restoration of natural grassland vegetation, pasturing seed plantation and converting grazing land to grassland. As a result, further deterioration of the vegetation cover could be contained and the productive capacity of the soil enhanced.[25]

36. The rehabilitation of bush and motley-grass ecosystems on degraded river plains and the improvement of the living standards of the local population are the twin objectives of the pilot project "Zhanartu" ("Renovation") being implemented by the "Zhangeldy" village community in Kazakhstan. Those objectives are being achieved by transferring the grazing of large numbers of livestock to pastures farther away from the village so as to decrease grazing pressure on the nearest pastures.

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[22] *Ecosystems and Human Well-being: Current State and Trends*, Millennium Ecosystem Assessment, 2005, World Resources Institute, Washington, D.C., chapter 22, "Dryland systems", p. 631.

[23] *Ecosystems and Human Well-being: Desertification Synthesis*. Millennium Ecosystem Assessment, 2005, World Resources Institute, Washington, D.C., p. 6.

[24] David Thomas, People, "Deserts and Drylands in the Developing World". Policy Briefs, Science and Development Network (SciDevNet), October 2006, p. 3.

[25] China National Committee for the Implementation of the UNCCD (CCICCD), China National Report on the Implementation of the United Nations Convention to Combat Desertification, Beijing, June 2006, p. 19.

The project has already achieved some results both in preventing soil erosion and restoring vegetation and in improving the living standards of the villagers. The increase in animal production has increased food security in the village. Moreover, some families are already able to offer the produce from their animals for sale at the market. At present, the activities carried out by village members are entirely self-financed.[26]

37. In Ethiopia, "area enclosure" has proved to be a particularly low-cost and effective approach to rehabilitation. It is a process by which eroded areas of land are protected from grazing for a period of years to allow for the natural regeneration of the original vegetation. Soil and water conservation measures, including terracing and the planting of trees and grasses, are increasingly used to assist the process. Community ownership of the process has been the key to its success. The communities draw up the laws and regulations on which piece of land is to be enclosed and protected, and when and how usage will again be permitted.[27]

38. Australia's experience suggests that the large-scale rehabilitation of degraded grassland resources requires addressing a combination of factors with an integrated approach. Overall, time frames are long and significant commitment is required to achieve long-term goals. The regeneration of the Ord River catchment, which was the largest and most ambitious undertaking of its kind in Australia and one of the few successful examples of such wide-scale rehabilitation, demonstrated the usefulness of taking an integrated and long-term approach.[28]

2. Forestation

39. Globally, the United Nations Convention to Combat Desertification estimated that more than 15 million hectares of tropical forests are depleted or burned every year in order to provide for small-scale agriculture or cattle ranching, or for use as fuel wood for heating and cooking.[29] Losses were greatest in Africa and in Latin America and the Caribbean.

40. Many developing countries undertook concrete initiatives in sustainable forest management, recognizing the important contributions that forests can make to combating desertification, land degradation and climate change. Afforestation, reforestation and forest protection schemes have been implemented to maximize the value of forest products and returns of investments in sustainable forest management. Some countries adopted new forest laws. Efforts are also being made to improve law enforcement. Some examples at the country level are provided in box III.

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[26] http://www.unccd.entico.com.

[27] http://www.unccd.int/publicinfo/localcommunities/ethiopia.

[28] Paul Novelly and I. Watson, "Successful grassland regeneration in a severely degraded catchment: A whole of Government approach in North-West Australia". Case study presented to the International Workshop on Climate and Land Degradation, Arusha, 11-15 December 2006 (abstract).

[29] "The United Nations Convention to Combat Desertification (UNCCD): a carrying pillar in the global combat against land degradation and food insecurity". Background paper for the San Rossore meeting, "Climate change: a new global vision", Pisa, Italy, 15-16 July 2004.

Box III
Sustainable forest management: some country examples

Burundi's new Forest Code treats forests as a common good that must be protected and only be exploited if due attention is paid to the impact on the environment. Protecting forests is also seen as a means to reduce poverty and prevent migration, as forest-related activities offer income-generating opportunities.

The reforestation programmes applied in Cape Verde from 1974 to 2004 managed to afforest some 90,000 hectares, of which approximately 5,000 were afforested from 2002 to 2004 alone.

Indonesia has undertaken serious reforestation efforts to rehabilitate degraded land, through, among other things, the National Forest and Land Rehabilitation Programme and the National Movement on Forest and Land Rehabilitation launched in 2003.

The cornerstone of Malaysia's National Forest Policy is the establishment of permanent reserved forests to ensure sustainable management of about 4.8 million hectares of forested land that has been designated as permanent reserved forest. It is an area that comprises 36.8 per cent of Malaysia's total land area.

Since 1998, farmers in Brazil have had to maintain 80 per cent of their land as forest (50 per cent in some special areas) as a legal forest reserve. Small-scale forest management enables smallholders to make economic use of their forest reserves.

Sources: *Implementing the United Nations Convention to Combat Desertification in Africa: Ten African Experiences*, United Nations Convention to Combat Desertification, Bonn, Germany, 2006; Yang Youlin and Lu Qui, "Challenges and Priority Areas to Implement the United Nations Convention to Combat Desertification in South-East Asian countries". Asia Regional Coordination Unit of the United Nations Convention to Combat Desertification secretariat/United Nations Economic and Social Commission for Asia and the Pacific/China National Research and Development Centre for Combating Desertification, Chinese Academy of Forestry; United Nations Environment Programme, *Global Environment Outlook: Environment for Development (GEO 4)*, Valletta, 2007.

41. The Operation Acacia project, launched in 2003 and implemented by FAO with financial support from the Government of Italy, has helped local farmers to restore degraded land by planting Acacias that produce gums and resins — important products for Sahelian people's livelihoods. Participating countries are Burkina Faso, Chad, Kenya, the Niger, Senegal and the Sudan. The project has trained about 56,000 producers of gum arabic and resin on ways to improve their production in order to meet international market standards. As a result, more than 13,000 hectares of degraded land have been restored. This has improved animal feeding and reduced conflicts between farmers and pastoralists. The sale of gum and

resin overseas has brought in much needed cash to the region and helped the farmers diversify and increase their sources of income. [30]

42. According to FAO experience gained with the implementation of forest projects in desertification-affected countries in Africa, forestation was found successful when the following conditions were jointly applied:

- Local people were involved all along the process, from the conception to the management of the new resources
- Large monospecific tree stands were avoided and, instead, a patchwork of different vegetation cover types was implemented, with crop and tree species selected by the beneficiary populations
- Locally adapted species, especially in regard to water availability and water demand, were considered
- Restored land and vegetative cover were protected from the causes of their degradation, mostly the harvesting of fuel wood, grazing and fires.

3. Natural regeneration

43. Most recent research studies indicate a significant greening of parts of the African Sahel during the 1990s, comprising, in particular, parts of Senegal, Mali, Chad, the Niger and the central plateau of Burkina Faso.

44. Some studies found that the increase in vegetation cover can be explained by increased rainfall in some regions of the Sahel, but not in others. Improved land management, such as increased investments in soil and water conservation, together with the application of improved soil and water conservation techniques, and the expansion of irrigation may have played a part. In addition to improved land management, other factors, such as reduced area under cultivation as a result of high rural-urban migration, might also have contributed to the observed trend of increased vegetation in the Sahel.[31]

45. According to the 2005 Millennium Ecosystem Assessment *Desertification Synthesis* report, long-term remote sensing studies indicate extensive recovery of vegetation productivity in many parts of the Sahel region after the droughts, suggesting that it was almost completely controlled by rainfall.[32] This confirms the findings of other studies, which argue that changes in vegetation cover, at least on a regional scale, appear to be primarily driven by climatic variability, suggesting that

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[30] Food and Agriculture Organization of the United Nations, "Killing two birds with one stone: transferring knowledge to fight poverty and land degradation" (http://www.fao.org/forestry/newsroom/en/news); "Operation Acacia: boosting production of gums and natural resins" (http://www.fao.org/english/newsroom/news).

[31] Stefanie M. Herrman, Assaf Anyamba and Compton J. Tucker, "Recent trends in vegetation dynamics in the African Sahel and their relationship to climate". Global Environmental Change Part A, vol. 15, issue 4, December 2005, pp. 394-404; L. Olsson, L. Eklundh and J. Ardo, "A recent greening of the Sahel: trends, patterns and potential causes". *Journal of Arid Environments 63* (2005), pp. 556-566.

[32] *Ecosystems and Human Well-being: Desertification Synthesis*. Millennium Ecosystem Assessment, 2005, World Resources Institute, Washington, D.C., p. 20.

vegetation can quickly recolonize areas that have apparently experienced desertification, when rainfall permits.[33]

D. Maintaining freshwater bodies and groundwater resources

46. Inefficient water use in irrigated agriculture, land degradation and exposure to drought have increased the pressure on freshwater bodies and groundwater resources in many dry lands. As water tables fall, salinity increases and water quality declines, with associated negative impacts on human and animal health, soil productivity and biodiversity.

47. The Kalahari basin of southern Africa, for example, is experiencing falling water tables because of increased sedentary livestock production. Research indicates that water is being recharged at no more than 1 millimetre per annum in the centre of the basin, while extraction has lowered the water table over a meter in some places in recent years.[34] In remote parts of Mongolia, where nomadic pastoralism is persisting, pumped wells are collapsing, restricting livestock movements and increasing the pressure on seasonal rivers.[35]

48. Agriculture in the countries of West Asia's Gulf Cooperation Council contributes less than 2 per cent to gross domestic product in Council countries, but it overexploits groundwater resources, most of which are non-renewable, resulting in their depletion and quality deterioration owing to seawater intrusion and the up-flow of saltwater.[36]

49. A series of protective measures have been implemented in watersheds in countries of northern Africa to make better use of investments in water-control structures. The application of newer technologies and practices for improved fallow periods, microbasins and windbreaks has gained momentum in light of participatory approaches to soil conservation.[37]

50. Regulating water pumping can help re-establish groundwater resources, as successfully proven at the Azraq oasis in Jordan. Despite years of groundwater decline, the oasis was restored after a Government and Global Environment Facility project started regulating pumping.[38] In part of northern China, where groundwater resources have been overexploited, the water exploitation has been restricted and water recharge measures have been taken.

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[33] Nick Brooks, "Drought in the African Sahel: Long-Term Perspectives and Future Prospects". Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, United Kingdom, Working Paper, No. 61, October 2004, p. 11; Charney, J., Quirk, W. J., Chow, S. H. and Kornfield, J., "A Comparative Study of the Effects of Albedo Change on Drought in Semi-Arid Regions". In: *Journal of the Atmospheric Sciences*, vol. 34, issue 9, American Meteorological Society, Boston, United States of America, 1977, pp. 1366-1385.

[34] D. S. G. Thomas, The Environmental Impact of Groundwater Exploitation in African Grasslands. Proceedings of the Dubai 2002 International Conference on Integrated Management of Water Resources in the Third Millennium, Balkema, Rotterdam, 2002.

[35] David Thomas, People, Deserts and Drylands in the Developing World. Policy Briefs, Science and Development Network (SciDevNet), October 2006, p. 5.

[36] United Nations Environment Programme, *Global Environment Outlook: Environment for Development* (GEO 4), Valletta, Malta, 2007, p. 267.

[37] *Global Deserts Outlook*, *GEO Year Book 2006* (executive summary), UNEP (Nairobi, 2006).

[38] Theib Oweis, "Improving access to water in deserts and dry lands". Policy Briefs, Science and Development Network (SciDevNet), October 2006, p. 2.

51. In an attempt to promote the sharing of water resources in Africa, the African Water Facility and the Sahara and Sahel Observatory recently signed a grant agreement worth €487,800 to finance the joint GEO-AQUIFER Knowledge Improvement and Northern Sahara Aquifer System Project. The project intends to promote concerted actions among Algeria, the Libyan Arab Jamahiriya and Tunisia, which share the Northern Sahara Aquifer System, and capacity-building in the three countries to enable efficient management of the shared water resource.[39]

E. Means of implementation

1. Finance

52. Though national budgetary allocations to combat desertification and mitigate the effects of drought have increased in some of the affected countries, many other countries have not been able to secure the needed financial resources. The 2007 Africa Review Report on Drought and Desertification noted that the lack of financial resources remains one of the most pressing constraints to implementation of desertification control plans in most of the countries in the African region.

53. Efforts to attract private sector investments in sectors relevant to desertification and drought often failed owing to the lack of financial incentives that could help to secure profitable investment returns. Poverty and inadequate access to affordable credit facilities prevented local people from acquiring funding that they could profitably invest in measures to prevent land degradation and sustain their livelihoods.

54. Some countries have set up National Desertification Funds as part of the National Action Programme process, which serve as local and easily accessible sources of funding for the implementation of Programme priorities. Some country examples with regard to securing funds for combating desertification are provided in box IV.

Box IV
Securing funds for combating desertification: some country examples

In 2004, Kenya established the Desertification Community Trust Fund with a Board of Trustees, with representation from the public and private sectors and from civil society. The Fund has benefited from significant contributions from the private sector. Its objectives are to facilitate research on desertification, enhance environmental management and capacity-building, raise public awareness and provide grants for sustainable environmental management.

In 2003, Morocco, with the support of the Global Mechanism of the United Nations Convention to Combat Desertification, devised a strategy to overcome the constraints facing the country in securing adequate funding for combating desertification. The strategy provides the framework for: (a) identifying priority programmes and projects on

[39] "Mobilizing Resources for Water in Africa", African Development Bank, January 2007 (press release).

desertification through a consultative process; (b) identifying sources of finance to support the implementation of those programmes and projects; and (c) creating compatibilities between the selected priority programmes and projects and external funding opportunities.[40]

The Government of Indonesia has mobilized and provided funds for reforestation and land rehabilitation measures. Efforts are coordinated by the Ministry of Finance and the Ministry of Forestry. Sources of these funds were national and local budgets and the National Reforestation Fund.

Sources: *Implementing the United Nations Convention to Combat Desertification in Africa: Ten African Experiences*, United Nations Convention to Combat Desertification, Bonn, Germany, 2006, pp. 19, 24 and 25; Yang Youlin and Lu Qui, "Challenges and Priority Areas to Implement the United Nations Convention to Combat Desertification and National Action Programme to Combat Desertification in South-East Asian Countries", p. 12.

55. There seems to be a growing awareness concerning markets and payments for ecosystem services. The 2006 Meeting of the East and Southern Africa Katoomba Group, for example, reported that countries in Africa have become increasingly interested in market-based conservation strategies, such as payment for ecosystem services, and a number of projects are under way.[41] Similarly, the report of the fifth session of the Committee for the Review of the Implementation of the United Nations Convention to Combat Desertification (CRIC-5), held in Buenos Aires in March 2007, noted that progress has been achieved in obtaining commitments from Governments to earmark budgetary allocations, rural credit or payment for ecosystem services.

56. For many countries, internationally funded projects are an important catalyst to implement their National Action Programmes established under the Convention. External financial assistance, however, is generally considered not to be commensurate with the financial needs of developing countries to combat desertification. The report of CRIC-3, for example, noted that financial assistance by development agencies often does not link up with National Action Programme priorities and that funding has rarely been channelled to the national desertification funds which some countries have established.[42]

57. The Global Environment Facility, through its implementing agencies (UNEP, the United Nations Development Programme and the World Bank), is providing support for programmes and activities to combat desertification and mitigate the effects of drought. The 2007 Africa Review Report on Drought and Desertification estimated that, from 2002 to 2004, the Facility funded more than $72 million worth

[40] Implementing the United Nations Convention to Combat Desertification in Africa: Ten African Experiences, United Nations Convention to Combat Desertification, Bonn, 2006, pp. 24 and 25.

[41] Catalizing Payments for Ecosystem Services in Africa: A Meeting of the East and Southern Africa Katoomba Group, Cape Town, South Africa, 8-10 November 2006 (conference overview).

[42] Committee for the Review of the Implementation of the United Nations Convention to Combat Desertification, Report of the Committee on its third session, held in Bonn, Germany, from 2-11 May 2005, pp. 8/9 (ICCD/CRIC(3)/9).

of projects focused primarily on combating deforestation and desertification globally.[43]

58. The United Nations Convention to Combat Desertification Global Mechanism is carrying out a number of programmes at the national and subregional levels to mobilize financial resources for Convention implementation. Lead agencies and countries have been designated under the Convention to facilitate the mobilization of financial and technical support in combating desertification.

2. Technology and traditional knowledge

59. Improved water and soil conservation technologies, new technologies to grow climate-resilient crops and other technologies that have the potential to enhance land productivity and increase agricultural production are available. Often, however, farmers are not aware of the potential of available technologies. Experience has shown that the knowledge of the actual gains that can be achieved with technology application, on a stable and long-term basis, is essential to the willingness of potential technology users to invest in new technologies and techniques.

60. Equally important is the capacity to use the technology in the most efficient manner. In Burkina Faso, Mali and the Niger, dry-land farmers have adopted, through an FAO project, the "microdose" technology that involves a rate of fertilizer application, which is only one third of the recommended rates for the areas. In all cases where "microdosing" fertilization was used, grain yields of millet and sorghum were reported to have increased 43 to 120 per cent.

61. Building on traditional knowledge has proven to be an effective way of self-help in dealing with the problems associated with desertification at the local and household levels, as it uses assets over which farming communities retain direct control. In Senegal and Burkina Faso, for example, rural farmers are successfully using traditional pruning and fertilizing techniques to double tree densities in semi-arid areas in order to hold soils together and reverse desertification. Similar community-initiated projects in Madagascar and Zimbabwe have been acclaimed successes.[44]

62. In Ethiopia, utilization of indigenous knowledge systems for land and natural resource management, such as in situ conservation of crop varieties, indigenous terrace building and application of an agroforestry system, have resulted in the reduction of the rate of genetic erosion and the restoration of the local seeds or landraces in regions where they were wiped out by severe drought, control of land degradation in some areas and improved biodiversity conservation in others.[45]

3. Information and capacity-building

63. The complexity of interactions between regional and local biophysical conditions and human interventions makes it difficult to determine the cause-and-effect of desertification correctly and to determine appropriate and timely responses.

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[43] Africa Review Report on Drought and Desertification (main report). Economic Commission for Africa, July 2007, pp. 33 and 34 (ECA/FSSD/ACSD-5/3).

[44] Economic Commission for Africa, State of Environment in Africa, Addis Ababa, 2006, p. 9 (ECA/FSSDD/01/06).

[45] Africa Review Report on Drought and Desertification (main report). Economic Commission for Africa, July 2007, p. 23 (ECA/FSSD/ACSD-5/3).

The use of remote sensing technology allows for better monitoring and mapping of desertification processes, thereby facilitating greater diagnostic analysis and potential identification of trends.

64. The establishment of information systems, inventories of desertification-affected or desertification-prone areas, centralized land-use information complemented by quantitative and qualitative analysis, and on-site and remote-control monitoring systems have been included as priorities in several National Action Programmes on desertification.[46]

65. Some African countries have established desertification information systems as part of the National Action Programme process to assist in monitoring interventions in order to combat desertification and mitigate drought impacts. A long-term ecological monitoring and observatory network has been established in the Sahel subregion and has facilitated observatories in 11 countries to gather information on the evolution of natural resources and the effectiveness of management systems.

66. In China, the National Natural Resources Committee approved and funded a research project entitled "Desertification Occurrence Mechanism and Optimistic Model for Combating Desertification", which includes the topic of "indicators system of desertification classification and expert system".[47]

67. The UNEP/FAO Land Degradation Assessment in Dry Lands systematically observes land degradation to increase understanding of drought and desertification processes and their effects. A new, quantitative global assessment under the Assessment identifies black spots of land degradation by trends analysis of the last 25 years' net primary productivity (NPP or biomass production). NPP is derived from satellite measurements of the normalized difference vegetation index (NDVI or greenness index).[48]

68. Capacity-building of local communities to reinforce their control over resources and their products and empower them to get fair access to resources is at the core of the work of FAO with countries and partners in combating desertification. Increasing recognition is being given to the value of ecosystem-based approaches that address the interactions among components in the land use system and take due account of the biophysical, socio-economic and policy context. Traditional knowledge and experience is built on by promoting farmer innovations and experimentation, combined with technical advice that draws from the latest research and scientific development.

69. The FAO Farmer Field School Approach for integrated soil management, which follows the principles of people-centred learning and is based on experience in Africa, has been developed as an alternative to the conventional top-down test and verification extension approach. It uses innovative and participatory methods to

[46] Committee for the Review of the Implementation of the United Nations Convention to Combat Desertification, Report of the Committee on its fifth session, held in Buenos Aires from 12 to 21 March 2007, p. 30 (ICCD/CRIC(5)/L.1).

[47] China National Committee for the Implementation of the UNCCD (CCICCD), China National Report on the Implementation of the United Nation Convention to Combat Desertification, Beijing, June 2006.

[48] United Nations Environment Programme, *Global Environmental Outlook: Environment for Development (GEO 4)*, Valletta, 2007, p. 124.

create a learning environment, where land users have the opportunity to learn from each others' experience in areas such as crop production, soil and water conservation, water harvesting and irrigation.

4. National action programmes

70. Action programmes on desertification are considered key instruments in the implementation of the Convention. Currently, about 80 countries have drawn up a National Action Programme, and some other countries are in various stages of preparing one. National Action Programmes have been supplemented by regional and subregional action programmes developed through consultations among the countries of the respective region or subregion.

71. There is a notable trend towards achieving better coherence among programmes to combat desertification and national development plans and poverty reduction strategies. The 2006 China National Report on the Implementation of the Convention, for example, noted that the strategic objectives of combating desertification have been incorporated into the National Economic Development Plan. Burundi, Kenya, Tunisia, Burkina Faso and Uganda are among the countries that have succeeded in mainstreaming National Action Programmes into national development plans and poverty reduction strategies. In many other countries, however, mainstreaming the Programmes into national development frameworks is often constrained by the lack of capacity in areas such as integrated planning, cross-sector coordination and information and knowledge management.

72. Given that desertification reaches across many development sectors, intersectoral cooperation has been encouraged in the preparation of National Action Programmes. In Africa, some countries are establishing National Coordinating Bodies to facilitate cross-sectoral and integrated planning of desertification control programmes.

73. The Government of China established the National Committee for the Implementation of the United Nations Convention to Combat Desertification (CCICCD), which is composed of 17 ministries and State commissions. The secretariat of CCICCD is responsible for guiding, coordinating and supervising the actions being undertaken to combat desertification. In addition, the Government has set up National Coordinating Groups in the affected provinces to ensure effective management in the implementation of actions between the central and local levels.[49]

74. As reported in various national reports on the implementation of the Convention, the National Action Programme process has contributed to the capacity-building of participating stakeholders at the national and local levels, empowering them to deal with drought and desertification more effectively. The participatory approach used in the process has encouraged the mobilization of resources and enabled central, State and local governmental authorities to better coordinate actions and allocate resources where they are needed most. In some cases, it has triggered institutional and legislative reforms supportive of effective policies and measures to combat desertification and mitigate the effects of drought.

[49] China National Committee for the Implementation of the UNCCD (CCICCD), China National Report on the Implementation of the United Nations Convention to Combat Desertification, Beijing, June 2006.

75. Most African countries, for example, have organized national awareness-raising seminars in order to launch the process of formulating their National Action Programmes. In the Niger, the National Environmental Council for Sustainable Development launched a capacity-building project to enable more coordinated consultations with non-governmental organizations that are engaged in the fight against desertification. Recognizing the high strategic importance of coordinating the various players actively involved in the fight against desertification, Tunisia created a National Committee for Combating Desertification, which was upgraded in 2005 to a National Council for Combating Desertification.[50]

76. Limited progress, however, has been noted with regard to National Action Programme implementation. With respect to Africa, a 2005 analysis prepared by the secretariat of the Convention stated: "while most of the countries of the region have had national action programmes for several years, meaningful progress has not been made with their operational implementation".[51] The 2007 Economic Commission for Africa Africa Review Report on Drought and Desertification noted that several African country reports identified capacity and resources constraints as well as the lack of integration of desertification control programmes into planning and budgetary frameworks at various levels, among the main impediments to Programme implementation.

III. Continuing challenges

77. The level of rural poverty in many developing countries affected by desertification and drought, which is particularly high in the African region, continues to be the overarching challenge in the fight against desertification and the most serious constraint to progress in combating desertification and mitigating the impact of drought.

78. Changing to more sustainable practices and methods in agricultural and pastoral land use remains a major challenge to achieving long-term progress in the fight against land degradation and desertification.

79. The projected intensification of freshwater scarcity will cause greater stresses in dry lands. If left unmitigated, such stresses will further exacerbate desertification.

80. Weak institutional and legal structures and capacities, poor coordination and collaboration among stakeholders involved in combating desertification and poor enforcement of legislation to guarantee clear legal ownership and access rights to land, water and other natural resources continue to hamper the implementation of focused and effective interventions.

81. Insecure land tenure and lack of access to markets are among the main barriers to the willingness of land users to invest in long-term sustainable land management. When farmers and herders lose control or long-term security over the land they use, the incentives for maintaining and improving land productivity are lost since they would in all likelihood not be able to reap the future rewards of such investments. Similarly, if farmers lack the opportunity to sell their agricultural products on the

[50] Implementing the United Nations Convention to Combat Desertification in Africa: Ten African Experiences, United Nations Convention to Combat Desertification, Bonn, 2006, pp. 22 and 36.

[51] ICCD/CRIC(3)/2/Add.1, para. 13.

market, they have little to gain by investing in more sustainable and output-increasing agricultural practices.

82. Although the integration of priorities identified in the national action plans to combat desertification into national development and budgeting frameworks has been recognized as important for resource allocation, fostering political commitment and mobilizing bilateral and multilateral financial and technical assistance, the actual process of integration remains slow in many countries, hampering speedy and effective implementation of anti-desertification interventions.

83. In the campaign against desertification and land degradation in many affected developing countries, difficulties continue to be faced in mobilizing needed large and long-term investments from central and local government budgets alone. Providing economic and non-economic incentives to other national stakeholders to encourage investments in the sustainable management of land, forests and other ecosystems can play a critical role in the mobilization of needed financial resources.

84. Many affected developing countries are lacking the scientific and technological means for effectively dealing with desertification and land degradation. Dissemination of appropriate new and emerging technologies from laboratories to field application in those countries, with assistance from development partners, remains a challenge.

85. There are still major knowledge gaps existing, for example, with regard to understanding the interactions between biophysical, human and climatic factors and their impacts on desertification processes and in using holistic approaches to combat desertification and foster the sustainable development of dry lands. There are also scientific challenges in detecting thresholds beyond which the changes to dry-land systems would be irreversible.[52]

86. The monitoring of desertification trends and the assessment of their socio-economic causes and impacts, which is considered central to the identification of focused interventions, is often hampered by the inadequate institutional and technical capacities of information and climate observation systems to access and analyse remote sensing material and to disseminate accurate and user-relevant data and information in a timely fashion.

87. Strengthening support by the international community remains crucial for implementing action programmes to combat desertification and land degradation in affected developing countries. The 10-year strategic plan and framework adopted by the Conference of the Parties to the United Nations Convention to Combat Desertification at its eighth session has strengthened the commitment of the international community to combat desertification, mitigate the effects of drought and combat climate change. The Convention offers a platform for adaptation, mitigation and resilience.

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[52] Discussion papers of major groups submitted to the Commission on Sustainable Development at its sixteenth session: contribution by the scientific and technological community (E/CN.17/2008/13/Add.8).